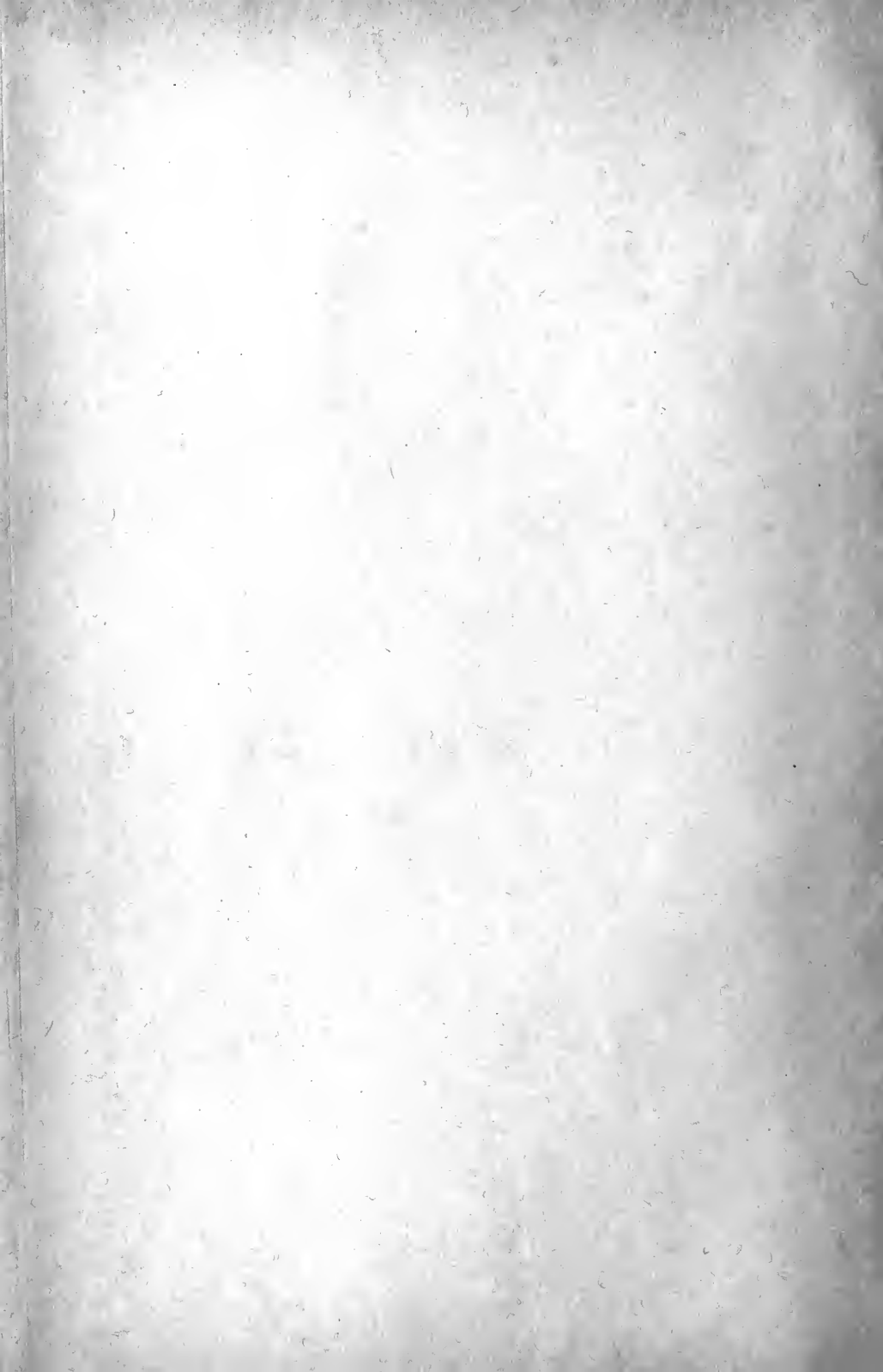




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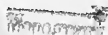
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THE ACHIEVEMENT
OF
SUBNORMAL CHILDREN
IN
STANDARDIZED
EDUCATIONAL TESTS



By J. E. WALLACE WALLIN, Ph. D.,

*Director Bureau of Special Education
(Subnormal and Delinquent Children)
Teachers College of Miami University.*





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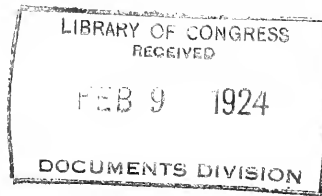
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INTRODUCTION

The first public school classes instituted for mentally subnormal children were intended for the feeble-minded. The first class was established in the public schools of the city of Halle, Germany, in 1859. The development of these classes was at first very slow.* Austria did not establish any public day classes until 1885 (in Vienna), England until 1892 (in Leicester and London), the United States until 1896 (in Providence), France until 1909 (in Paris), and Canada until 1910 (in Toronto).

Usually at first the pupils were assigned to these classes on the recommendation of the school medical inspectors, the principals and the teachers, without any special examination to determine whether the child's pedagogical retardation was due to mental deficiency or to any one of a number of other causes, such as lack of interest or application, late entrance in school, frequent absences or transfers, physical defects or illness, specific mental or pedagogical defects, defects in the course of study itself, incompetency on the part of the teacher, lack of rapport between the pupil and the teacher, etc. The determination of the relative influence of the various factors which conceivably were causally related to the child's pedagogical incompetency was left to the common sense appraisal of the teaching and medical staffs of the schools. Where the final selection was entrusted to the school physician, it is probable that his judgment was primarily based on the teachers' reports and only secondarily on the results of the physical examination and the sketchy mental examination which the examiner could give by means of a few common-sense questions.

The unsatisfactory nature of this common sense method of selecting the pupils who should be assigned to the classes for mental defectives, gradually became recognized and led Binet, the brilliant French psychologist and child study expert, to develop a scale of intelligence by means of which it would be possible for the trained examiner to determine approximately by a series of simple, uniform and objective tests the child's general level of intelligence, or his degree of intelligence retardation. Binet recognized that the very essence of feeble-mindedness was intelligence deficiency, and that no child could be considered feeble-minded and subject for assignment to a special school unless he were genuinely deficient in intelligence by a certain amount (not definitely specified by Binet) no matter how little he knew or how unstable he might be in his emotional or motor reactions. This scale, which was first offered by Binet and Simon in 1905 and revised by them in 1908 and 1911 and which has passed through a number of other revisions in this country and elsewhere, speedily won almost universal recognition, and fairly revolutionized the method of selecting pupils for the special classes for mental defectives, and greatly stimulated the development of these classes. In fact, it practically superseded all other methods of selection, because of the recognized superiority of a uniform, objective scale, no matter what its defects might be, as compared with the subjective judgment of the individual examiners. The popularity of this scale is largely responsible for the development and extension of group intelligence testing, which has reached its highest development in the army tests, and also for the present-day popularity of mental testing in general.

Unfortunately the general employment of the Binet scale for the selection of pupils

*We have discussed the development of public day classes for subnormals and psychological clinics in "Problems of Subnormality," 1917, pp. 46-109, 278-331; and "The Mental Health of the School Child," 1917 (reprint), pp. 22-117, 337-428.

for special classes for mental defectives has not been an unmixed good, due less to the assumptions made as to the accuracy of the original or revised scales than to the arbitrary standards of mental deficiency which have been widely followed, and to the overconfident claims as to the diagnostic possibilities of the scale in the hands of anyone who could administer it. The arbitrary intelligence standards of mental deficiency which have been frequently followed, have resulted in the assignment of many pupils to the special classes for mental defectives who are not feeble-minded, as frequently proved by their after-careers. The majority of those who have used the scale have had little training in science and often little or no scientific or practical knowledge of feeble-mindedness, and of the differential diagnosis between feeble-mindedness and various allied mental handicaps, such as backward or borderline degrees of intelligence, visual, auditory and motor aphasia, various speech disorders, specific sensory deficiencies ranging from deafness and blindness to semi vision and semi hearing, specific pedagogical defects, or psychopathic and psychotic tendencies. In the vast majority of public school studies of mental deviates no mention whatever has been made of most of the deficiencies which must be differentiated from feeble-mindedness. In consequence many children have been assigned to special schools for the feeble-minded, who are specifically or otherwise mentally handicapped and who have ranged in general intelligence from normal to merely backward or borderline, and who should have been assigned to other types of classes. We could cite many illustrative cases.

Fortunately the situation is gradually improving. It is now becoming recognized that no one is fully competent to differentiate different types of mentally and educationally deviating children for different types of special classes who has not made a thorough study of the psychology and pedagogy of the different types, who is not an expert on mental tests, and who does not have a general background of knowledge of physical diagnosis, if physical examiners are not available. In other words, competent examiners of mentally and educationally abnormal school children are doctors of psychology (clinical psychologists) who have specialized for several years on these children, and doctors of medicine who have spent several years in the intensive technical study of not only these children but of experimental, educational and genetic psychology and mental tests. Anyone without this preparation must be classed as an amateur in this particular field of educational service. Amateurs, however, can be trained to administer tests satisfactorily; they are capable of becoming very excellent mental testers; but they should not attempt to make anything but rough classifications of cases.

In contrast to the enormous extension of the psychological testing of subnormal children, little attempt has thus far been made to determine the status of subnormal children in educational tests, due probably, first, to the fact that the development of standardized educational group tests on any scale followed the development of psychological tests for individual examination (although it preceded the employment of group psychological tests on a large scale);* and, second, to the fact that the use of educational tests for purposes of diagnosing mental deficiency is entirely secondary to the use of psychological tests. Educational tests measure accomplishment or achievement rather than capacity, while psychological tests measure capacity—ideally inherent or native capacity rather than accomplishment. This contrast while not

*The writer devised a series of group psychological tests as early as 1910, which have been used in testing children receiving dental treatment (*Experimental Oral Euthenics*, Dental Cosmos, 1912, 404ff. and 545ff; and *The Mental Health of the School Child*, 1917, pp. 275-299, 313), and in measuring the mental differences between epileptic and normal children, as yet available only in *Problems of Subnormality*, 1917, pp. 350-381.

Other psychologists also used series of group intelligence tests many years ago, but such tests never came into wide usage before the organization of psychological work in the army a few years ago.

literally true, is in the main correct. Nevertheless, educational tests have been very widely employed throughout the schools of the country several years in order to determine the proper grade placement of the pupils and the special attention which they should be given in the various subjects, and certainly we will not have an adequate picture of subnormal children until we have measured their educational achievements as well as their mental efficiency. It is, therefore, a matter of surprise that no special public schools for mental defectives either in this country or in Europe have thus far, so far as the writer is aware, been surveyed by standardized educational tests. Small groups of feeble-minded children have, no doubt, been tested, but in the surveys of school systems made in this country in which standardized educational tests have been employed, the tests have not been applied to the mental defectives who have been in segregated classes. In the recent St. Louis survey, educational tests were extensively used, but the special schools were not included. In April, 1918, we published indeed a survey* of the pedagogical status of the pupils in the St. Louis special schools for mental defectives, but the pupils' ratings were based upon the grade classification given them before assignment by the teachers in the elementary schools and the classification given them after assignment in reading and arithmetic by the teachers in the special schools.

The present study should have a two-fold significance for teachers, superintendents of schools, psychologists, physicians and mental hygienists interested in the study and training of feeble-minded and backward children: first, it is the only survey thus far made by several standardized educational tests of pupils enrolled in special schools for mental defectives; second, most of the pupils tested had been psychologically examined and differentially diagnosed, so that it is possible to analyze the results from the educational tests with reference to the children's intelligence age, to their diagnostic classification, such as imbeciles, morons, borderline, backward, visual aphasia cases, etc., and to the grade assigned them by the special school teachers.

One of the chief values attached to our comparison of the results in the educational tests with the diagnoses arises from the fact that each child assigned to the special schools by the writer had been thoroughly studied both before and since the admission from the standpoint of the physical, mental, educational, and social conditions, while, we have tried to be fairly cautious and conservative in our diagnoses, particularly regarding the diagnosis of feeble-mindedness. Our results should therefore be of value to the practical school man in assisting him to check up the admissions to classes designed specifically for mental defectives. We have found that children assigned to such classes and to state residential institutions vary enormously in their pedagogical attainments, some doing work in the upper elementary grades.† We are strongly convinced after years of first hand investigation that it is undesirable to assign children to classes for mental defectives who are not feeble-minded (certainly if they grade above the borderline status) whenever it is possible to have two or more special classes.‡ If our conclusions reached after a decade of intensive first-hand study of the problem are correct, it will be necessary to restrict the admissions to classes for mental defectives far more rigidly in future than has been done in the past in this country, if we wish to do the best work for the individual mental deviate made possible by the present state of the science of corrective pedagogy. This study is in harmony with the conclusion which we had

*The Pedagogical Status of the Feeble-minded School Children, *The Elementary School Journal* 1918, pp. 588 to 597.

†Problems of Subnormality, 1917, 34f, 86f.

‡Ibid, 64f. Meeting the Needs of the Mentally Handicapped Child in School, *Ohio Bulletin of Charities and Correction*, 1919, June, and *Journal of Education*, 1919, pp. 227f.

already reached that only about one-half of one per cent of our elementary pupils should be assigned to the special schools for the mental defectives while the other types of mentally subnormal pupils, probably amounting to from 3% to 5% of the elementary registration in the average school system, should be assigned to other types of special classes, particularly ungraded classes of the type we have described in Problems of Subnormality, Chapter III.

We have given a considerable number of individual case histories of extreme deviates and special types, which will add concreteness to the discussion.

The following tests were used in the present investigation: lists A to F and I, L, and O in Ayres' spelling scale,* and lists I and II in Starch's spelling scale;† Gray's oral reading scale;‡ and the spiral arithmetic exercises adapted from the standard Courtis tests, which had previously been given to grade pupils in Grand Rapids, Cleveland and St. Louis§ (modifications of moment were made in section K in the Cleveland survey).

*Ayers, Leonard, P. A Measuring Scale for Ability in Spelling. Russell Sage Foundation, 1915.

†Starch, Daniel. Educational Measurements, 1916, p. 89f.

‡Gray, William Scott. Studies of Elementary School Reading through Standardized Tests, p. 33, undated.

§Counts, George S. Arithmetic Tests and Studies in the Psychology of Arithmetic, 1917, p. 8f.

CHAPTER I.

THE ACHIEVEMENT OF SUBNORMAL PUPILS IN THE SPELLING TESTS

The tests were given by the different teachers in the St. Louis special schools during the months of January and February, 1918. Oral and written instructions, in conformity with the author's directions, were first communicated by the writer to the teachers giving the tests. The necessity of guarding against copying was especially emphasized, as well as the fact that the pupils should not be drilled on the words in the selected lists before the tests were given (we have since then, however, based part of the spelling lessons on the Ayres lists). The Ayres lists were given on the first day, Starch I on the second day, and Starch II on the third.

The instructions were to give 20 words each in columns I, L, and O in the Ayres scale to all the pupils who could spell any of the words in these columns, and all the words in lists A to G to all the other pupils. When the data were received analysis showed that the number given column G varied so greatly (from 3 to 27 words) that it is not worth while to include the results from this list, that many pupils were not given lists I, L and O who, as shown by the results, should have been tested on these words, that other pupils who did poorly in these lists were not tested at all on the easier lists, and that a considerable number of pupils were not tested at all, as shown below. Because of the considerable variation in the number tested on the different columns, it seems desirable, even at the risk of unduly increasing the amount of tabular matter, to give the number of boys and girls tested on each list. The unevenness of the number tested on the different lists gives rise to disturbing complications to which we shall later direct attention.

Two hundred and fifty-nine different pupils (171 boys and 88 girls) were given the Ayres lists, and 237 the Starch lists (160 boys and 77 girls), while it was reported that 20 boys and 5 girls of those given the intelligence examination in the clinic were not tested because they were unable to spell, or because they had not been taught to spell, or because they were unable to write. Of these children six had an intelligence age (Binet-Simon) of III, seven of IV, eight of V, two of VI and one of VII, one was undetermined, while 16 had been diagnosed as imbeciles, one as a potential moron, two as morons, and one each as potential feeble-minded, borderline and deferred. The number registered in the special schools the last week of January, 1918, was 372, hence it is evident that many children were not tested who were neither reported as absent nor as unable to take the test. This omission is unfortunate, for it limits our results to a selected group, the best spellers in the schools at the time of the test. As indicated, the instructions provided that *all* pupils should be tested on some lists irrespective of their attainments.

The average chronological age and the average number of years in school at the time of the spelling test were as follows:

DIAGNOSES

	Imbeciles	Pot. Morons	Morons	Pot. Feeble- Minded	Border- line	Deferred
Chron. Age.....	11.7	10.0	11.0	8.3	8.0	7.8
Years in School.....	3.3	2.4	2.4	3.4	1.1	2.5

BINET-SIMON AGES

	III	IV	V	VI	VII
Chron. Age.....	11.2	11.5	9.2	13.5	13.8
Years in School.....	3.5	2.2	2.3	7.4	2.7

To those who are unfamiliar with the above diagnostic terms, let us explain that the *imbecile* represents the lowest grade of feeble-minded child who ordinarily gets into the public schools, having an intelligence age of from three to six or seven according to the Binet-Simon tests, while the *moron* represents the high grade feeble-minded individual, varying in intelligence age from seven or eight to nine years, or very rarely ten years. It is customary to use Roman numerals to indicate the Binet-Simon or intelligence age. *Potential morons* grade as imbeciles at the time of the examination, but probably have sufficient potentiality for mental growth to eventually develop to the status of morons. On the other hand, the *potential feeble-minded* while not certainly feeble-minded at the time of the examination, give evidence of having very limited potentiality for mental growth, and probably will eventually prove to be feeble-minded. Some of those included in the *borderline* group will also eventually stagnate in the feeble-minded class, others will remain on the borderline slightly above the feeble-minded status, while others will prove to be merely backward or dull. Those who are classed as *backward* are clearly not feeble-minded, but they are just as clearly not normal. A few may be restored to normality by proper physical and educational treatment but the vast majority will always remain subgrade in general intelligence, although if given appropriate training they may be made very efficient in certain fields of work particularly along manual lines. We apply the term *retarded* to pupils who are less behind mentally than the backward. Most of these children if given proper attention can be restored to normality. We use the term *subnormal* as the generic concept applying to all of the above classes. In the case of the *deferred* we have, for one reason or another, reserved our diagnosis. We shall later discuss the technical application of the concept of feeble-mindedness. For a discussion of the psychometric standards of mental retardation on the basis of which we differentiate between various groups of subnormals, consult our Problems of Subnormality, pp. 110-277, and The Value of the Intelligence Quotient for Individual Diagnosis, Journal of Delinquency, 1919, pp. 109-124. In these two references citations will be found to the important literature bearing on the topic. Here we content ourselves with the statement that the difference between the subgroups of mentally subnormal children is quantitative rather than qualitative.

The results of the tests have been tabulated in a threefold manner: first, according to the pupils' school grade; second, according to the intelligence or Binet-Simon (B.-S.) age; and, third, according to the intelligence diagnosis. The pedagogical classi-

fication is based upon the grade assigned the pupil in reading when the reading tests were given two or three months later in the year. At the time of the spelling test the teachers did not report the grade the pupils had reached in their daily spelling work, nor have they generally graded the pupils in spelling in their annual reports to the psycho-educational clinic, owing to the fact that their grade standards in spelling are not very definite, partly because they have devoted less attention to the formal teaching of spelling than to the teaching of reading and number and partly because they have not followed very closely the spelling lists which have been used in the regular grades in the St. Louis Schools. The only basis on which we could grade the pupils, therefore, was the grade reported in reading. The grade in spelling probably approximates the grade in reading more closely than the grade in, say, arithmetic. But it must be emphasized that the correlation between proficiency in spelling and reading is not by any means perfect. Some pupils read beautifully but spell miserably, while some pupils spell well, at least orally, but read poorly. The pedagogical grading, therefore, is only a rough one.

The Binet-Simon age is based on the Stanford revision for pupils examined in the psycho-educational clinic since September, 1917, and on the 1911 edition (*Vineland*) of the old scale for pupils tested prior to this date. Of the pupils given the Ayres lists 52 were graded by the former as against 141 by the latter revision, while for the pupils taking the Starch lists the corresponding figures are 46 and 127. All the intelligence examinations (as well as the diagnoses) were made by the writer. Since the Binet age relates to the time when the pupils were given the intelligence examination, and not to the time when they were given the spelling tests, we have given the average chronological age both at the time of the Binet-Simon examination and at the time of the spelling tests. The "number of years in school" applies to the date when the spelling tests were given, but the figures given in the tables are only approximately accurate. In many cases the records were so incomplete that the age in school could not be ascertained at all, while in other cases the records were probably only approximately correct. It is particularly difficult to determine how long a child has been in school if he has attended a number of public and private schools.

Many pupils who were given the spelling tests had been admitted to the special classes before the psycho-educational clinic was established. No Binet-Simon records or diagnoses are available for these pupils, and they are therefore excluded from the tabulations according to Binet-Simon age and diagnosis.

ANALYSIS OF RESULTS

RELATION OF SPELLING ACHIEVEMENT TO ASCENDING CATEGORY

No one who was classified as of kindergarten or lower grade was given the spelling tests. This makes it impossible to determine the number of words which they might have spelled had they been tested. However, many, perhaps most, of these pupils had been given very little formal instruction in spelling, because of their low mentality. On the other hand, the pupils with a B.-S. mentality of III and IV years who were tested (a selected lot) scored in all the lists, one (case One, born in St. Louis of German-American parents) doing remarkably well in Ayres I, L and O, and fairly well in Starch I and II. However, it is necessary to explain that his mental rating of 4.2 was obtained in 1914 at the age of 8.16. Undoubtedly he grades higher mentally now than when he was tested, and the same statement applies to all of the other pupils who were given the B.-S. tests several years prior to the educational tests. This boy practically stood still mentally the first year in school. Since then he has been improving steadily.

The spelling proficiency, as measured by these word lists, tends to increase from grade to grade, from B.-S. age to B.-S. age, and from intelligence classification to intelligence classification, but there are numerous exceptions to this tendency.

Thus, for the Ayres lists there is an improvement in the grade classification, as shown in Table I, with ascending grade in 18 and a decrease in 3 of the 21 possible comparisons in the different columns. The average age at the time of the spelling test increases slightly with each ascending grade, but the time in school is practically the same for the three upper grades. The improvement from grade I to grade II in lists I, L and O amounts to 2., 3.2 and .09 words, respectively; from grade II to III,—.06 (a loss), 1.3 and 10.5, respectively; and from grade III to IV, 2.8, 6.8 and 1.4, words, respectively. It is evident that the improvement from grade to grade is not very marked, with one or two exceptions.

In Table II, where the data are grouped according to B.-S. age, there is an increase in 34, and a decrease in 19 of the 53 possible comparisons. Based on the medians, Table III, there is an increase in 25, a decrease in 17 and equal scores in 11 of the comparisons.

TABLE I
NUMBER OF WORDS SPELLED CORRECTLY IN THE AYRES SCALE
TABULATED ACCORDING TO GRADE

Sex	No.	Chron. Age at Time of		Yrs. in School	Columns											
		B.S. Test	Spell. Test		A	B	C	D	E	F	I	L	O			
First Grade																
Boys.....	92	77	92	75	64	64	64	63	66	60	25	25	25	Number		
Boys.....		10.01	11.25	4.61	1.49	2.83	5.53	4.93	8.54	7.18	13.4	9.04	5.52	... Score		
Girls.....	42	38	42	38	31	31	31	31	32	29	10	10	10	Number		
Girls.....		9.9	11.25	4.33	1.67	3.09	5.93	4.93	9.19	8	9.6	5.6	1.5	... Score		
Both.....	134	115	134	113	95	95	95	94	98	89	35	35	35	Number		
Both.....		9.97	11.25	4.56	1.55	2.92	5.66	4.93	8.68	7.44	12.31	8.05	4.37	... Score		
Both.....					77	73	80	54	51	41	76	40	22	Per cent		
Second Grade																
Boys.....	49	31	49	30	1	1	1	1	9	9	40	40	34	Number		
Boys.....		11.15	13.	6.29	1.	3.	7.	8.	14.44	15.44	15.62	11.37	4.7	... Score		
Girls.....	30	20	30	20	6	6	6	6	7	7	18	23	22	Number		
Girls.....		11.94	13.	6.4	2	3.66	7.	7.16	14.42	14.14	20.77	11.3	4.09	... Score		
Both.....	79	51	79	50	7	7	7	7	16	16	58	63	56	Number		
Both.....		11.46	13.	6.33	1.85	3.57	7.	7.28	14.43	14.43	17.22	11.34	4.46	... Score		
Both.....					93	89	100	81	85	80	96	57	22	Per cent		
Third Grade																
Boys.....	29	19	29	19	1	1	1	1	1	1	28	28	28	Number		
Boys.....		11.87	13.6	6.65	2.	4.	5.	9.	17.	15.	17.67	15.17	8.5	... Score		
Girls.....	15	8	15	8	1	1	1	1	1	1	14	14	14	Number		
Girls.....		12.2	14.08	5.19	2.	4.	6.	8.	13	17.	16.14	7.63	27.92	... Score		
Both.....	44	27	44	27	2	2	2	2	2	2	42	42	42	Number		
Both.....		11.93	13.7	6.22	2.	4.	5.5	8.5	15.	16.	17.16	12.66	14.97	... Score		
Both.....					100	100	79	94	88	89	96	63	75	Per cent		
Fourth Grade																
Boys.....	1	1	1	1							1	1	1	Number		
Boys.....		14.6	14.4	6.34							20	20	16	... Score		
Girls.....	1	1	1	1							1	1	1	Number		
Girls.....		13.25	14.5	7.66							20	17	11	... Score		
Both.....	2	2	2	2							2	2	2	Number		
Both.....		13.92	14.45	7.							20.	19.5	13.5	... Score		
Both.....											100	98	68	Per cent		
Gen. Ave. for all Grades																
Boys.....	171	128	171	125	66	66	66	65	76	70	94	94	88	Number		
Boys.....		10.60	12.23	5.18	1.46	2.86	5.54	5.04	9.38	8.35	15.69	11.97	6.27	... Score		
Boys.....					73	71	79	56	55	46	78	60	31	Per cent		
Girls.....	88	67	88	67	38	38	38	38	40	37	43	48	47	Number		
Girls.....		10.83	12.3	4.94	1.73	3.21	6.1	5.36	9.9	9.4	17.25	11.64	4.72	... Score		
Girls.....					86	80	87	60	58	52	86	58	24	Per cent		
Both.....	259	195	259	192	104	104	104	103	116	107	137	142	135	Number		
Both.....		10.68	12.25	5.09	1.56	2.99	5.75	5.16	9.58	8.71	16.18	11.86	5.73	... Score		
Both.....					78	74	82	57	56	48	81	59	29	Per cent		

TABLE II. (Concluded)
GENERAL AVERAGES FOR ALL B.-S. AGES

Sex	No.	Chron. Age at Time of		Years in School	Columns									
		B.-S. Test	Spell. Test		A	B	C	D	E	F	I	L	O	
Boys	128	128	128	126	57	57	57	56	63	58	64	64	64	Number
Boys		10.63	12.01	5 41	1.52	2.91	5.49	5 1	9.11	7.96	15.14	11.01	5.57	Score
Boys					76	72	78	57	54	44	75	55.	27	Per cent
Girls	66	66	66	66	33	33	33	33	34	31	32	32	32	Number
Girls		10 43	12 08	4.94	1.69	3.15	6.0	5.0	9.2	7.87	15 37	11.71	4.43	Score
Both					84	78	85	56	54	44	77	59	22	Per cent
Both	194	194	194	192	90	90	90	89	97	89	96	96	96	Number
Both		10.56	12.03	5.35	1.58	3.0	5.67	5.06	9.15	7 93	15.21	11.25	5.19	Score
					79	75	81	56	54	44	76	56	26	Per cent

No., number of pupils. Chron. (Chronological age), refers to the exact calendar or life age of the child. The figures in the lines marked "score" are all averages; the figures in columns three and four represent average chronological ages, and in column five average number of years in school. Unless stated otherwise the conclusions drawn in the text are based on the average scores. The per cents, computed only for the combined scores for the two sexes, were secured by dividing the total number of words found in lists A to F and by 20 words each in lists I, L, and O, into the average number of words spelled correctly in the different columns. Decimals have been ignored in the quotients.

These explanations apply to all the tables except Table III.

TABLE III
NUMBER OF WORDS SPELLED CORRECTLY IN AYRES SCALE (MEDIANS)
ACCORDING TO B.-S. AGE

Age	A	B	C	D	E	F	I	L	O	
Age III										
Boys	2	2	6	7	13	1.5				Number
	100	50	85	77	76	8				Per cent
Age IV										
Boys	2	2	4	5	5	4	20	14	14	Number
Girls	2	4	7	3.5	9	4				Number
Both	2	4	7	4	7	4	20	14	14	Number
	100	100	100	44	41	22	100	70	70	Per cent
Age V										
Boys	2	4	6	4	11	7	19 5	13 5	16	Number
Girls	2	3	6	4.5	7	13	11	11	1.5	Number
Both	2	3	6	4	9	7	17.5	12.5	7 5	Number
	100	75	85	44	52	33	87	62	37	Per cent
Age VI										
Boys	2	3	6	6	8	3	16	11	5	Number
Girls	2	3	6	5	7	3	16	12	2	Number
Both	2	3	6	5	7	3	16	11.5	3.5	Number
	100	75	85	55	41	16	80	57	17	Per cent
Age VII										
Boys	2	3	5.5	6.5	12	8	15	9	1.5	Number
Girls	2	4	7	7	13	13	15	11	3	Number
Both	2	4	7	7	12	9	15	10	2	Number
	100	100	100	77	70	50	75	50	10	Per cent
Age VIII										
Boys	2	4	7	7 5	14.5	13	16.5	12	4	Number
Girls	2	4	7	8	14	14.5	16	11.5	4	Number
Both	2	4	7	8	15	14	16	11.5	4	Number
	100	100	100	88	88	77	80	57	20	Per cent
Age IX										
Boys							18	14	4 5	Number
Girls						16	20	19	11	Number
Both						16	18	19.5	5	Number
					94	100	97	75	25	Per cent
Age X										
Boys	1						5	3 5		Number
	50						25	17		Per cent
Age XI										
Boys							20	20	16	Number
							100	100	80	Per cent

The median is the middle measure when all the measures are arranged according to size. Number means the number of words spelled correctly.

The average chronological ages at the time of the spelling test do not increase here from B.-S. ages III to V, but show a slight increase upward from age V. The average amount of time in school tends to increase slightly, although irregularly, from age VI. In view of these facts, it is not without significance that 8 of the failures of the scores to improve are between ages III and IV, and IV and V. If we restrict the comparison to columns I, L and O, we find that there are more losses than gains, and that the improvement where it occurs is very small. The following figures indicate the change from age to age in average number of words of gain or loss (the losses are shown by a minus sign):

Column	IV to V	V to VI	VI to VII	VII to VIII	VIII to IX
I	-3.75	-1.82	-.29	1.91	1.75
L	-1.75	-1.19	-1.42	2.36	2.
O	-5.25	-3.32	-1.98	1.99	.56

One reason why so little correlation between spelling proficiency and intelligence is shown in these columns is undoubtedly the one we have already suggested: the poorer pupils in the lower B.-S. ages were not tested on these columns, hence the relatively high scores in these ages. Of 6 IV-year olds, 23 V-year olds, 48 VI-year olds, and 56 VII-year olds, only 1, 4, 16 and 28 subjects in these ages, respectively, were tested on these columns.

In Table IV, where the data are averaged according to intelligence diagnosis, there is an increase in 29, a decrease in 15 and equal scores in one of the 45 possible comparisons of the figures in the different columns between the ascending categories. We are not including the "deferred" subjects in whose case the diagnosis was suspended and who average younger in age than any other group with the exception of the normal, who are also disregarded because the group contains only one subject. The following figures show for columns I, L and O the average number of words of improvement or loss (minus sign) from classification to classification.

	I	L	O
Imbeciles to Potential Morons	-7.2	-8.4	-7.
Potential Morons to Morons	6.5	9.3	4.6
Morons to Potential Feeble-Minded . . . . .	.5	.75	-.25
Potential Feeble-Minded to Borderline	2.39	2.58	2.21
Borderline to Backward	-2.62	-2.88	-2.56

The results for the potential morons are of no significance as only one of the six was given columns I, L and O.

TABLE IV
NUMBER OF WORDS SPELLED CORRECTLY IN AYRES SCALE
ACCORDING TO DIAGNOSIS

Sex	No.	Chron. Age at Time of		Years in School	Columns										No. Score	
		B.-S. Test	Spell. Test		A	B	C	D	E	F	I	L	O			
Imbeciles																
Boys.....	15	15	15	15	13	13	13	13	13	12	2	2	2		No.	
Boys.....		9.12	10.97	3 88	1 38	2 61	4.92	4.3	6.3	5.08	19.5	13.5	16.3		Score	
Girls.....	12	12	12	12	9	9	9	9	9	3	3	3	3		No.	
Girls.....		9.83	11.43	4 37	1.33	2 77	5.11	3	4.88	3 88	12.33	6.66	3 1		Score	
Both.....	27	27	27	27	22	22	22	22	22	21	5	5	5		No.	
Both.....		10.61	11.18	4 1	1.36	2 68	5	3.77	5 72	4 57	15.2	9.4	7		Score	
					68	67	71	41	33	25	76	47	35	%	
Potential Morons																
Boys.....	3	3	3	3	1	1	1	1	2	1	1	1	1		No.	
Boys.....		10.72	11.2	4 5	2	4	7	7	14	17	8	1	0		Score	
Girls.....	3	3	3	3	3	3	3	3	3	2					No.	
Girls.....		10.72	10.84	2 92	1 66	2 66	3	3 66	7 33	5 5					Score	
Both.....	6	6	6	6	4	4	4	4	5	3	1	1	1		No.	
Both.....		10.72	11.02	3 71	1 75	3	6 25	4 5	10	9 33	8	1	0		Score	
					87	75	89	50	58	52	40	5	0	%	
Morons																
Boys.....	31	31	31	31	12	12	12	12	14	14	17	17	17		No.	
Boys.....		11.94	12.92	5 93	1 75	3 08	6.08	5.91	9 14	8 64	14 23	9 64	4 88		Score	
Girls.....	17	17	17	17	3	3	3	3	3	3	14	14	14		No.	
Girls.....		12.79	14.07	6 08	2	4	7	7 33	13 66	14 66	15 28	11 78	4 85		Score	
Both.....	48	48	48	48	15	15	15	15	17	17	31	31	31		No.	
Both.....		12.24	13 33	5 99	1 8	3 26	6 26	6 2	9 94	9 7	4 7	10 61	4 87		Score	
					90	81	89	68	58	54	74	53	24	%	
Potential Feeble-Minded																
Boys.....	23	23	23	23	16	16	16	15	15	13	7	7	7		No.	
Boys.....		10.02	10.41	3 34	1 31	2 37	4 75	3 73	6 73	5 46	15 42	11	5 14		Score	
Girls.....	12	12	12	12	7	7	7	7	7	6	5	5	5		No.	
Girls.....		10.03	10.58	4 54	1 57	2 57	5 57	4 28	7	5 5	14	11 2	3 4		Score	
Both.....	35	35	35	35	23	23	23	22	22	19	12	12	12		No.	
Both.....		10 02	10 5	3 47	1 39	2 43	5	3 9	6 81	5 47	14 83	11 08	4 41		Score	
					69	60	71	43	40	30	72	55	22	%	
Borderline																
Boys.....	32	32	32	32	8	8	8	8	11	11	21	21	21		No.	
Boys.....		11.03	12 78	6 12	1 37	3 12	6 12	6	11 27	9 9	17	13 66	6 85		Score	
Girls.....	8	8	8	8	1	1	1	1	2	1	6	6	6		No.	
Girls.....		12 26	13 3	5 55	2	4	7	9	15 5	18	18	13 66	5 83		Score	
Both.....	40	40	40	40	9	9	9	9	13	12	27	27	27		No.	
Both.....		11 27	13 11	6 17	1 33	3 22	6 22	6 33	11 92	10 58	17 22	13 66	6 62		Score	
					66	80	88	70	70	58	86	68	33	%	
Backward																
Boys.....	16	16	16	15	4	4	4	4	5	5	11	11	11		No.	
Boys.....		10 21	12 5	5 69	2	4	5 75	6 25	13 6	11 2	14	10	3 63		Score	
Girls.....	6	6	6	6	3	3	3	3	3	3	3	3	3		No.	
Girls.....		9 1	11 34	4 72	2	4	7	7	13 6	13	16 66	13 66	5 66		Score	
Both.....	22	22	22	21	7	7	7	7	8	8	14	14	14		No.	
Both.....		9 91	12 16	5 49	2	4	6 28	6 57	13 62	11 87	14 57	10 78	4 06		Score	
					100	100	89	73	80	66	72	53	20	%	
Deferred																
Boys.....	8	8	8	8	3	3	3	3	3	2	5	5	5		No.	
Boys.....		9 35	11 25	4 94	2	4	7	7 66	14 66	13 5	12 2	7 8	4 6		Score	
Girls.....	7	7	7	7	6	6	6	6	6	6	1	1	1		No.	
Girls.....		9 05	9 33	3 34	2	3 5	6 5	6	11 83	10	13	11	2		Score	
Both.....	15	15	15	15	9	9	9	9	9	8	6	6	6		No.	
Both.....		9 21	10 33	4 19	2	3 64	6 66	6 55	12 77	10 88	12 33	8 33	4 16		Score	
					100	91	96	72	75	60	61	41	20	%	
Normal																
Girls.....	1	1	1	1	1	1	1	1	1	1					No.	
Girls.....		8 4	9 58	4 59	2	4	7	9	14	4					Score	
					100	100	100	100	82	22				%	

The increase in age from category to category and in the length of time spent in school are not constant in this table, and this fact probably accounts in part for the numerous instances of non-improvement. Thus the potential feeble-minded, who might be assumed to be somewhat more intelligent than those definitely diagnosed as morons, did poorer than the morons in every column except I and L. But they had been two and a half years less in school on the average than the morons, and averaged 2.8 years younger. The fact, again, that the backward did poorer than the borderline in columns I, L and O may be due to the circumstance that they had been in school two thirds of a year less and averaged almost a year younger. Moreover, not all the backward or borderline were tested on these lists. Notwithstanding the complication due to difference of age and time in school it is probable that the increase would have been more marked in the diagnosis classification had less categories been used—e. g., if we had merged the imbeciles with the potential morons (who graded as imbeciles at the time of the intelligence examination, but who gave evidence of possessing sufficient capacity to advance to the status of morons), and the potential feeble-minded with the borderline. Here, again, it is probably safe to conclude that the reason the improvement with increasing intelligence diagnosis was not more marked is the fact that the teachers did not test many pupils sufficiently extensively. Some were not tested far enough down, while others were not tested far enough up. The pupils in the lower classifications tested on I, L and O, were superior to those who were not tested on these lists. Had all the pupils been included the scores in the lower classifications would probably have been lower, and thus the increase with ascending category would, of course, have been more marked.

With the Starch lists the same process of selection obtained, in fact 26 pupils who took the Ayres test were not given the Starch, while only 4 who were given the Starch did not get the Ayres. However, since only two Starch lists were used, since the number tested in each list differs only slightly and since, in any case, the difference in the difficulty of the two lists is not markedly pronounced, we shall be in better position to trace improvement with ascending classification with the Starch lists than the Ayres lists, although the poorest spellers were not tested. In point of fact, the improvement is fairly marked in the Starch lists.

The improvement from grade to grade, Table V, occurs without exception, and, based on the averages of the two columns, amounts to 13.13 words between the first and second grades; 9.43 words between the second and third grades, and 18.66 words between the third and fourth grades.

TABLE V
NUMBER OF WORDS SPELLED CORRECTLY IN THE STARCH SCALE
TABULATED ACCORDING TO GRADE

Sex	No.	Chron. Age at Time of		Years in School	List I	List II	I and II	
		B.-S. Test	Spell. Test					
First Grade								
Boys.....	82	68	81	66	77	75	82	..... Number
Boys.....		10.07	11.54	4.52	6 76	9.57	7.94	..... Score*
Girls.....	33	29	33	29	28	32	33	..... Number
Girls.....		10.52	11.92	4.58	6.35	10.12	8.27	..... Score
Both.....	115	97	114	95	105	107	115	..... Number
Both.....		10.20	11.65	4 54	6.65	9.73	8 03	..... Score
Second Grade								
Boys.....	48	29	48	28	46	46	48	..... Number
Boys.....		11.19	13.05	6.12	21.19	23.26	21.95	..... Score
Girls.....	29	19	29	19	28	29	29	..... Number
Girls.....		11.85	13.0	6.24	18.28	21.13	19.84	..... Score
Both.....	77	48	77	47	74	75	77	..... Number
Both.....		11.45	13 03	6 17	20 09	22.44	21 16	..... Score
Third Grade								
Boys.....	29	19	29	19	28	25	29	..... Number
Boys.....		12.14	13.67	6.49	31.03	30 72	31.18	..... Score
Girls.....	14	8	14	8	14	14	14	..... Number
Girls.....		12.2	14 25	5.03	27.14	30 78	29.35	..... Score
Both.....	43	27	43	27	42	39	43	..... Number
Both.....		12.16	13.86	6.13	29 76	30 74	30.59	..... Score
Fourth Grade								
Boys.....	1	1	1	1	1	1	1	..... Number
Boys.....		14.6	14.59	6 34	54	58	56	..... Score
Girls.....	1	1	1	1	1	1	1	..... Number
Girls.....		13.25	14.5	7.66	47	38	42.5	..... Score
Both.....	2	2	2	2	2	2	2	..... Number
Both.....		13.92	14.54	7	50.5	48	49.25	..... Score
General Average for all Grades								
Boys.....	160	117	159	114	152	147	160	..... Number
Boys.....		10 72	12.4	5 26	15 91	17.1	16 66	..... Score
Girls.....	77	57	77	57	71	76	77	..... Number
Girls.....		11 24	12 78	5.24	15.74	18.5	16.9	..... Score
Both.....	237	174	236	171	223	223	237	..... Number
Both.....		10.89	12.53	5 26	15.86	18.02	16 74	..... Score

*The averages for the columns containing the words spelled correctly can also be read as per cents in the Starch tables.

The average chronological age increases without exception and the amount of time spent in school also increases with one unimportant exception from grade to grade.

There is no exception among the B.-S. categories, Table VI, except in Age X, where the cases are too few to make the results significant, more particularly because both of the subjects happened to be pupils with dyslexia (to whom we shall presently refer).

TABLE VI
NUMBER OF WORDS SPELLED CORRECTLY IN THE STARCH SCALE
TABULATED ACCORDING TO B.-S. AGE

Sex	No.	Chron. Age at Time of		Years in School	List I	List II	I and II	
		B.-S. Test	Spell. Test					
Age III								
Boys.....	3	3	3	3	3	3	3	..... Number
Boys.....	.....	8.7	10.47	3 44	1 33	4 66	3	..... Score
Age IV								
Boys.....	2	2	2	2	2	2	2	..... Number
Boys.....	.....	7 6	10.69	3.74	2.5	8	5.25	..... Score
Girls.....	2	2	2	2	2	2	2	..... Number
Girls.....	.....	7.66	10.88	2.69	1.5	3 5	2 5	..... Score
Both.....	4	4	4	4	4	4	4	..... Number
Both.....	.....	7.63	10.83	3.71	2	5.75	3.87	..... Score
Age V								
Boys.....	12	12	12	12	12	10	12	..... Number
Boys.....	.....	8.67	10.29	3.62	5.5	6.7	6.12	..... Score
Girls.....	8	8	8	8	8	8	8	..... Number
Girls.....	.....	8.9	9 94	3.15	5.37	7.49	6.43	..... Score
Both.....	20	20	20	20	20	18	20	..... Number
Both.....	.....	8.76	10.15	3.43	5 45	7.05	6 25	..... Score
Age VI								
Boys.....	26	26	26	25	25	26	26	..... Number
Boys.....	.....	9.64	14.48	4.34	8.48	10 23	9 26	..... Score
Girls.....	14	14	14	14	13	13	14	..... Number
Girls.....	.....	9.7	11.63	4 6	11.38	12 53	11.32	..... Score
Both.....	40	40	40	39	38	39	40	..... Number
Both.....	.....	9.66	13.48	4.44	9 47	11 0	9 98	..... Score
Age VII								
Boys.....	34	34	34	33	30	28	32	..... Number
Boys.....	.....	11 07	12.39	5.47	10 66	12 92	11.23	..... Score
Girls.....	17	17	17	17	14	17	17	..... Number
Girls.....	.....	12 82	13.95	6.31	18.78	18 17	17 94	..... Score
Both.....	51	51	51	50	44	45	49	..... Number
Both.....	.....	11.66	12.91	5.92	13.25	14 91	13.56	..... Score
Age VIII								
Boys.....	34	34	34	33	30	31	34	..... Number
Boys.....	.....	11.87	13 28	6 35	22.73	23 22	23 05	..... Score
Girls.....	14	14	14	14	14	14	14	..... Number
Girls.....	.....	12 3	13.41	6.47	19.35	22	20 32	..... Score
Both.....	48	48	48	47	44	45	48	..... Number
Both.....	.....	11 99	13.32	6.39	21 65	22 84	22.26	..... Score
Age IX								
Boys.....	4	4	4	4	4	4	4	..... Number
Boys.....	.....	12.66	14.34	6.61	27	28 25	27 62	..... Score
Girls.....	2	2	2	2	2	2	2	..... Number
Girls.....	.....	14.13	14 38	3.09	26	26	26	..... Score
Both.....	6	6	6	6	6	6	6	..... Number
Both.....	.....	13.15	14.35	5.6	26.66	27 5	27 08	..... Score
Age X								
Boys.....	2	2	2	2	2	2	2	..... Number
Boys.....	.....	12.24	13.38	7 04	8.5	13.5	11.0	..... Score

The increase (average number of words) from age to age for the averages of the two columns is as follows:

B.-S. Age.....	III to IV	IV to V	V to VI	VI to VII	VII to VIII	VIII to IX	IX to X
Increase .....	.87	2.3	3.7	3.5	8.2	5.2	-16*

*Loss.

Based on the medians for the combined figures of columns I and II, Table VII, the increases are as follows:

B.-S. Age	III to IV	IV to V	V to VI	VI to VII	VII to VIII	VIII to IX	IX to X
Increase.....	0	3.	1.	5.	8.	6.5	-16.5*

*Loss.

In some ages the increase is greater for the medians, in others for the averages.

TABLE VII

NUMBER OF WORDS SPELLED CORRECTLY IN THE STARCH SCALE (MEDIAN)
TABULATED ACCORDING TO B.-S. AGE

	List I	List II	I and II
	No. Words	No. Words	No. Words
Age III			
Boys.....	1	4	3
Age IV			
Boys.....	2.5	8	4.5
Girls.....	1.5	3.5	2.
Both.....	1.5	5.	3.
Age V			
Boys.....	5.5	6.	6
Girls.....	2.	7	5.
Both.....	4.	6.	6.
Age VI			
Boys.....	5.	8	7.
Girls.....	10	13.	10.5
Both.....	5.5	8.	7.
Age VII			
Boys.....	9.	12.	11.
Girls.....	17.	18.	18.
Both.....	10.5	13.	12.
Age VIII			
Boys.....	20.5	22.	22.
Girls.....	16.	18.	16.
Both.....	19.	20.5	20.
Age IX			
Boys.....	24.5	27.	26.5
Girls.....	26.	26.	26.
Both.....	25.	27.	26.5
Age X			
Boys.....	8.5	13.5	10.

The average chronological ages and length of time in school increases, but not without exceptions, as we go from the lower to the higher B.-S ages.

When the results are grouped according to diagnosis, Table VIII, there is an increase with ascending categories except in two instances, as shown by the following differences between the combined figures for the two columns (in average number of words):

Category	Imb. to P. M.	P. M. to M.	M. to P. F.-M.	P. F.-M. to Bo.	Bo. to Back.
Increase .....	.65	10.	-5.9*	10.4	-3.0*

*Loss

TABLE VIII
NUMBER OF WORDS SPELLED CORRECTLY IN THE STARCH SCALE
TABULATED ACCORDING TO DIAGNOSIS

Sex	Chron. Age at Time of		Years in School	List I	List II	I and II	
	B.-S. Test	Spell. Test					
Imbeciles							
Boys	14	14	14	13	14	14	Number
Boys	9.51	11.07	4.14	4.00	5.42	4.75	Average
Girls	11	11	11	11	10	11	Number
Girls	9.97	11.56	4.4	6.18	7.7	6.68	Average
Both	25	25	25	24	24	25	Number
Both	9.71	11.29	4.25	5.0	6.33	5.6	Average
Potential Morons							
Boys	2	2	2	2	2	2	Number
Boys	10.35	10.88	3.39	6.5	9.5	8.0	Average
Girls	2	2	2	2	2	2	Number
Girls	11.54	11.42	2.71	3.5	5.5	4.5	Average
Both	4	4	4	4	4	4	Number
Both	10.94	11.15	3.05	5.	7.5	6.25	Average
Morons							
Boys	29	29	29	29	26	29	Number
Boys	11.97	13.15	5.85	14.31	15.84	15.22	Average
Girls	17	17	17	15	17	17	Number
Girls	12.92	14.29	6.46	18.13	18.94	18.23	Average
Both	46	46	46	44	43	46	Number
Both	12.32	13.57	6.08	15.57	17.06	16.33	Average
Potential Feeble-Minded							
Boys	19	19	17	19	18	19	Number
Boys	9.99	10.41	3.22	7.89	10.05	8.76	Average
Girls	9	9	9	8	9	9	Number
Girls	10.75	11.25	4.85	11.	14.44	13.88	Average
Both	28	28	26	27	27	28	Number
Both	10.23	10.68	3.78	8.81	11.51	10.41	Average
Borderline							
Boys	31	31	31	26	30	31	Number
Boys	11.	12.76	6.14	20.11	20.16	20.24	Average
Girls	8	8	8	8	8	8	Number
Girls	12.26	13.66	5.54	21.16	25.37	23.25	Average
Both	39	39	39	34	38	39	Number
Both	11.26	12.94	6.02	20.35	21.26	20.85	Average
Backward							
Boys	15	15	14	14	13	15	Number
Boys	10.42	12.73	5.83	18.42	21.92	19.2	Average
Girls	6	6	6	6	6	6	Number
Girls	9.1	11.34	4.72	13.83	14.83	14.33	Average
Both	21	21	20	20	19	21	Number
Both	10.05	12.33	5.73	17.05	19.68	17.8	Average
Deferred							
Boys	7	7	7	7	5	7	Number
Boys	9.3	11.26	4.84	7.56	11.2	8.78	Average
Girls	3	3	3	2	3	3	Number
Girls	8.61	10.5	3.85	8.	9.66	8.16	Average
Both	10	10	10	9	8	10	Number
Both	9.09	11.05	4.54	7.66	10.62	8.6	Average
Imbeciles & Potential Morons Combined							
Boys	16	16	16	15	16	16	Number
Boys	9.61	11.05	4.05	4.33	5.87	5.15	Average
Girls	13	13	13	13	12	13	Number
Girls	10.21	11.54	4.14	5.76	1.33	6.34	Average
Both	29	29	29	29	28	29	Number
Both	9.88	11.27	4.09	5.0	6.5	5.68	Average
Potential Feeble-Minded and Borderline Combined							
Boys	50	50	48	45	48	50	Number
Boys	10.62	11.87	5.10	14.95	16.37	15.88	Average
Girls	17	17	17	16	17	17	Number
Girls	11.46	12.38	5.17	16.06	19.58	18.29	Average
Both	67	67	65	61	65	67	Number
Both	10.83	12.0	5.12	15.24	17.21	16.49	Average
General Averages for all Diagnoses							
Boys	117	117	114	110	108	117	Number
Boys	10.71	12.15	5.23	13.29	15.12	14.25	Average
Girls	56	56	56	52	55	56	Number
Girls	11.21	12.55	5.2	13.51	15.65	14.53	Average
Both	173	173	170	162	163	173	Number
Both	10.87	12.28	5.22	13.36	15.17	14.34	Average

The failure of the potential feeble-minded to gain over the morons is probably due to the fact that they averaged 2.8 years younger at the time of the spelling test and had been 2.3 years less in school. That the backward did poorer than the borderline may also be due to the fact that they averaged over a half year younger at the time of the spelling test and had been in school almost a third of a year less. Moreover, our number of backward cases is quite limited. If we merge the imbeciles and potential morons, and designate them imbeciles, and the potential feeble-minded and borderline and designate them borderline, there are no exceptions to the rule between the general averages. The increase from imbeciles to morons is now 10.6 words; from morons to borderline, .16 (the borderline averaged a year and a half younger and had attended school almost a year less); and from borderline to backward, 1.3. The backward average about a third of a year older at the time of the spelling test and had been in school about a half year longer.

SEX DIFFERENCES

The differences in spelling efficiency, as determined by these word lists, between boys and girls are not constant and in most instances are quite negligible. There is a slight advantage, however, in favor of the girls. When the figures from the Ayres lists are arranged according to B.-S. age, Table II, the girls are superior to the boys in 32, inferior in 12 and equal in one of the 45 comparisons. When the medians are compared, Table III, the girls excel in 16, and the boys in 12 comparisons, while the scores are the same in 17. In the table containing the diagnoses, Table IV, the girls are superior in 32, inferior in 23 and equal in five of the 60 comparisons. In the grade tabulation, Table I, they are superior in 14, inferior in 14 and equal in 5 of the 33 comparisons. In the general averages for all the boys and girls in the tabulation according to B.-S. age (Table II), they are superior in 6 and inferior in 3 of the 9 comparisons, and superior in 7 and inferior in 2 of the comparisons in the tabulation according to grade (Table I). The differences are frequently unimportant. The following is the amount of difference between the general averages for all the boys and girls in each list of words:

LIST	A	B	C	D	E	F	I	L	O
Grade Tabulation (Table I)	.27	.35	.56	.32	.52	1.0	1.5	-.33	-1.5
B.-S. Tabulation (Table II)	.17 $\frac{1}{2}$	.24	.51	-.10	.09	-.09	.08	.53	-1.35

The minus sign indicates the girls are inferior.

Only in the case of columns F, I, and O does the difference amount to one word or more in the grade tabulation. In the B.-S. tabulation the difference amounts to as much as one word only in column O. In the tabulation according to B.-S. age the sex differences are smaller than in the tabulation according to grade in all the columns except one.

The results for the Starch words are discrepant in the different tabulations. When the results are averaged according to grade, Table V, the girls excel in 3 and the boys in 9 of the possible comparisons for lists I and II and the averages of I and II. When averaged according to B.-S. age, Table VI, the girls excel in 8 and the boys in 10 comparisons. On the other hand, when the results are averaged according to diagnoses, Table VIII, the girls excel in 12 and the boys in 6 of the comparisons. When the medians are used in the B.-S. classification, Table VII, the girls excel in 9, the

boys in 6, while the results are equal in 3 comparisons. In the averages for the entire group of boys and girls, Table VIII, the girls excel in both lists, but the difference between the boys and the girls is negligible, amounting to .22 word in list I, .53 word in list II and .22 word in the combined averages for the two lists. While the boys and girls had attended school equally long the girls were slightly older.

In our earlier study* of spelling efficiency among normal children the girls surpassed the boys. Rice and Cornman also found the same fact to be true.

*Spelling Efficiency in Relation to Age, grade and Sex, and the Question of Transfer, 1911, p. 49 ff.

COMPARISON OF THE SPELLING ATTAINMENT OF MENTAL DEFECTIVES WITH NORMAL PUPILS

The standards supplied with the Ayres scale do not enable us accurately to gauge the relative spelling proficiency of mentally defective children of varying grade of mentality, because Ayres' standards do not cover a sufficiently wide range of spelling attainment in the different grades, while no standards at all are supplied for the first grade even for the lists of easiest words. This makes it impossible to locate on the scale the very large proportion of our subjects who did not reach the second grade standards, nor is it possible to locate anyone on the scale who spelled less than 50% of the words in any column, as no norms below 50% are supplied. Owing to the restricted testing of the pupils, or the restricted range of norms supplied, no data are available for grading pupils below the third grade on the lists above L, or below the fourth grade on the lists above O, or below the fifth grade on the lists above R, etc. This seriously limits the practical value of the Ayres word lists as a measuring scale. For a very large number of our cases, all we can say is that the pupils did less than second grade work, or less than third grade work, how much less can only be conjectured. Moreover, when we attempt to determine the spelling status of pupils by the Ayres scale, pronounced discrepancies often arise according to the list of words used. This will appear in the later analyses. It would indeed be hazardous to attempt to determine a child's spelling efficiency by a single column in the Ayres scale. The chief merit of the scale, provided a sufficient number of lists are used, is that it enables us to test the proficiency of children in the spelling of words which are in very common use.

The chief merit of the Starch scale, contrariwise, is that it supplies norms for all the elementary grades (I to VIII) for graduated lists of words. The words included in Starch's six lists represent a fortuitous selection. The first defined word was chosen from every even-numbered page of Webster's New International Dictionary, 1910, exclusive of all technical, scientific and obsolete words. In each column the words are arranged according to size, which corresponds to the order of difficulty, according to Starch. He says that experiment has indicated that the spelling ability of a child can be accurately determined by the use of any two lists, the mean variation amounting to only 2.2 points when two columns are used on two successive occasions. "For practical purposes the differences among the six lists are negligible." With our subjects, we find that list II is almost uniformly easier than list I. Sometimes the differences are quite marked. The differences between the averages of the two lists for grades I, II, III and IV are 3.08, 2.35, .98 and 2.5 respectively. For the Binet-Simon ages the differences are as follows:

B.-S. Age	III	IV	V	VI	VII	VIII	IX	X
Difference	3.3	3.7	1.6	1.5	1.6	1.4	.9	5.

Based on the medians the differences are as follows:

B.-S Age	III	IV	V	VI	VII	VIII	IX	X
Difference	3.	3 5	2.	2.5	2.5	1.5	2.	5.

With one exception (of no importance because based on too few cases) the differences are largest in the two lowest grades and B.-S. ages.

The steps in the Starch scale are so large in the lower grades that the establishment of norms for the first and second sections of the classes is indicated.

The selection of the words for the lists by chance has its advantages, but also its special disadvantages. The lists are not particularly suitable for testing the attainment of mental defectives in spelling, because they are usually given a more restricted literary program in order that more time may be devoted to practical forms of manual training. Accordingly the instruction and drill in spelling are ordinarily limited to words whose meaning comes within the pupils' limited range of comprehension, to words occurring in the elementary forms of literary work pursued in the classes and to the common words which it is felt mental defectives should be able to spell in the limited fields of service open to them after leaving school.

In comparing the spelling attainments of special school children with normal children we are restricted to norms which have been established for the different elementary grades. The norms are given on the sheet containing the Ayres scale, and on p. 97 of Starch's "Educational Measurements." No norms are available for chronological or mental ages for the normal children. Ayres' results were obtained at mid-year, or about the same time that we tested our pupils, while Starch does not state when his tests were given.

In the first grade our average scores were less, in most instances decidedly less, than Ayres second grade norms in all the word lists except I, in which the pupils did fully as well as the second grade pupils. In List O, where there are no second grade norms, they did less than half as well as the third grade pupils. The scores of our second grade pupils were below the regular second grade norms in all the columns except C, I, and L, in which, respectively, they did as well as third, fourth and second grade pupils. In column O they scored not quite half as well as the normal third grade pupils. In our third grade the scores were below second grade standard in columns C and E, equal to second grade in A, B, D, and F, between second and third in L, and equal to grade four in I and O.

Our two fourth grade pupils scored V on I, grade VI on L and almost grade IV on O. One of these pupils (case Two), subject to spastic paralysis, had been assigned immediately on entering school (before the clinic was established) in September, 1911, to a special school. He was examined in the clinic in February, 1918, at the age of 14.66, and graded 11 years by the Stanford revision from the upper base (X) and 10.8 from the lower base (VIII), and 11.8 by the 1908 and 1911, the corresponding I. Q.'s* being .75 and .80. By the Seguin form board, a motor test, he measured less than 6.5 years, the low score being due to the extreme instability of his motor centers, manifest in gross tremors of the hand. It was so difficult for him to co-ordinate his nervous impulses that he could write only in a large, irregular scrawl. He also has extreme difficulty to articulate because of muscular paralysis. His speech is extremely labored. He required 49 seconds to read the selection in Age X, which is read in from 25 to 35

*The I. Q. (intelligence quotient) is obtained by dividing the chronological age into the intelligence age.

seconds by the normal ten-year olds. It was read without error, but with great deliberation, owing to his difficulty of articulation. The physical examination also showed that his gait was unsteady and spastic, the patellar reflexes exaggerated, the shoulders stooped and the nasal septum deflected. He was born (in the United States, of German descent) with instruments after a labor of 36 hours. The paralysis was said to date from birth and may have been due to birth traumatism although no known cause has been suggested. He was the first child of parents 27 years of age. In his early development he was normal in some things, and slow in others. He cut his first tooth at 4 months, sat without support at 12 months, stood at 2 years, took his first steps at 3½ years, and walked at 4 years. He used single words at 1 year, and short phrases at 1½ years. He had chicken pox at 1 year, measles at 2, and whooping cough at 4. The family history was negative. In the June, 1915, report from the special school he was reported to be excellent in sensory and mental games, faithful but physically hampered in physical training, very satisfactory in spool knitting, crude in drawing, with little control in writing. He read with intelligence in grade IV, told connected stories in good English, wrote poorly but used good thought and expressed himself well, was fair in spelling, did III³ in arithmetic (the superscript refers to the quarter), was very observant, concentrated well, showed very good judgment, general information was good, but he fatigued easily. In the June, 1916, report he was said to have improved in physical training, he had become stronger, his co-ordination was better, his loom work was good, expression in oral reproductions excellent, and he was doing fourth grade work in arithmetic. The June, 1917, report noted further improvement in physical training and manual work, but he was not very capable in gardening, he writes a typewriter, reads III, IV and IV³ materials, spells in IV³, does arithmetic in IV¹, his oral reproduction is very good, he has high moral standards, and is inclined to be too serious. In the Ayres I, L and O lists, given in January, 1918, he did fifth, seventh and between fourth and fifth grade work, and in the Starch lists he did between fourth and fifth grade work in I and almost fifth grade work in II. A short time after the clinic examination he was transferred as a backward case in February, 1918, to an ungraded class. The report from this school in November, 1918, showed that he was successfully doing V⁴ work, earning grades of G and E, and that he would soon be promoted to the sixth grade.* This type of retardate should be assigned to an ungraded class instead of a special school for mental defectives.

The other pupil (case Three, a German-American), classified in the fourth grade, was admitted to a special school in January, 1913, before the clinic was established. In the school report of June, 1915, at the age of 12, she was said to do excellently in all forms of physical training, she was good in sense training and mental games, gardening, writing, reading (grade III), oral language, and spelling, she was fair in raffia, reed, sewing, knitting and cooking, and poor in drawing and arithmetic (grade II). Her greatest capacity and greatest improvement were reported in reading, her information was said to be limited, she was reticent, easily influenced, pleasant, congenial, well behaved, but extremely nervous. She spent the next year in the country, going to school part of the time. In September, 1917, she returned to the city and was examined in the clinic. At the age of 13.25 years she graded 8.66 by the Stanford-Binet, showing a retardation of 4.59 years and an I. Q. of .65. In the Seguin form board she graded 10.5 years by the combined forms and a little over nine by the writer's norms.† She read fairly well, finishing the X-year selection in 32 seconds without error, and reproduced 13½ memories. The physical examination was negative

*In February, 1921, he was promoted to High School.

†Psycho-Motor Norms for Practical Diagnosis, 1916, Table XLIX.

as well as the developmental history so far as concerns past diseases. She cut her first tooth at 1 year, stood alone at 11 months, sat without support at 6 months, took her first steps without support at 8 months, walked at one year, but did not use single words until she was a year and a half old, nor speak in phrases or sentences until her sixth year. She was the twelfth child, having two sisters and four brothers alive, and six siblings dead. One brother had previously been in a special school. The family history was negative, based on the information elicited from the mother. She was diagnosed as a moron of the simple type and reassigned to the special school. The June, 1918, report from the special school indicated that she was excellent in physical training, good in wood work, domestic activities, gardening, writing, reading (III grade), oral and written language, and spelling (III grade), and fair in arithmetic (II grade), machine sewing and crocheting. She gave good attention, her general information was fair, judgment poor, conduct excellent, she was even tempered and sociable, did her best work in reading, and her greatest weakness was "self-consciousness." In the Ayres spelling test she did fifth grade work on I, almost fourth grade on L, and slightly better than third grade on O. On Starch I she did almost fourth grade work, and on II almost third grade. In Gray's oral reading test she scored 42.5, or almost II¹. This girl, in our judgment, would not grade lower than the highest grade of the feeble-minded, in fact it is doubtful whether some subjects of the same mental and educational status could be classified lower than borderline. However, she is perhaps more capable in spelling than in any other literary subject. There were six other pupils who had been diagnosed as morons who did about as well on the Ayres lists but not quite so well on the Starch lists. The records of these best spellers among our mental defectives are as follows:

Case No.	Sex	Age at Time of		B. S. Age	Ret'd.*	I. Q.	Years in School	Ayres' Columns		Starch's Columns		
		Spell. Test	B. S. Test					I	L	O	I	II
								% grade	% grade	% grade	% grade	% grade
Four.....	G.	14.2	13.0	8.8	4.2	.63	7.5	100 V	95 V	60 III½	46 III	35 II½
Five.....	G.	13.7	12.1	8.6	3.5	.69	7.	95 IV	80 III½	45-III	34 II½	32 II¼
Six.....	B.	12.5	10.9	7.4	3.5	.67	6.5	100 V	70 III	55 III	7-I	13 I½
Seven.....	B.	12.3	9.7	7.	2.7	.71	5.5	100 V	85-IV	90-VI	5-I	16 I¼
Eight.....	B.	17.6	15.5	8.4	7.1	.65	8.5	100 V	85-IV	45-III	29 II	27-II
Nine.....	B.	13.0	10.	7.4	2.5	.73	5.5	100 V	85-IV	40-III	36 II½	33 II½

*Retardation according to the B. S. scale.

All of these pupils except one did fifth grade work on Ayres I, only one reached fifth grade and three almost fourth grade on L, while five did only about third grade on O. On the Starch lists all varied from first to second grade except one who reached third grade. The discrepancy between the Ayres and Starch rating, and the rating by the different Ayres columns, is at once apparent. Cases Four, Six, Seven and Nine were given the spiral arithmetic test. No one made any scores beyond test F, except pupils Four and Nine, each of whom did two examples in J, addition of one place numbers, which is somewhat better than the standard for grade III², but not equal to III¹. Case Four did seven examples in A, 4 in B, 1 in C, and 3 in E and F; case Six did 3 in A, and one in E; case seven did 2 in A, and one in C; and case Nine did 7 in A, 2 in C and one in E. All of these scores are decidedly below the III² standard for the St. Louis schools*—no norms are available below III²—except the score for case Four in F, which is somewhat better than III². No scores were made except in the simple addition, multiplication and subtraction tests. Those who were given the Gray oral reading test scored as follows: case Four, 48.7 or less than III¹,

*Judd, Charles H. Arithmetic, in Vol. II, Pt. 5. of Survey of the St. Louis Schools, 1917, p. 192.

according to the St. Louis standards; *case Six, 0; case Seven, 18.7, or considerably less than I⁴; case Eight, 45. or less than II⁴;† and case Nine, 40, or a trifle better than II².

It is evident that the ratings in reading and in arithmetic more nearly resemble the rating by the Starch than by the Ayres scale, and that, based upon the reading, arithmetic and Starch tests not a single one of these mental defectives did satisfactory all-round third grade work, although they varied in chronological age from twelve to seventeen, in B.-S. age from 7 to 8.8 at the time of the examination, and in length of time in school from 5.5 to 8.5 years. All of these pupils were born in the United States except case Nine (a Jew born in Russia). Cases Four, Five and Six were of German descent.

The average Ayres scores for all the boys and girls, Table I, are below second grade standard, in most cases markedly so, in lists A to F, equal to second grade in L, between second and third grade in I, and below third grade in O. In the B.-S. ages IV to VII the scores are invariably below second grade standard in lists A to F, sometimes decidedly so. In list I the IV-year old boy, referred to before (case One), did fifth and in L and O, fourth grade work. In ages V to VII the average scores in list I were equal to second grade or better. In list L the score is between second and third grade in ages V and VI, and slightly below second in age VII. In list O the score is below third grade, markedly so in ages VI and VII. The VII-year olds did less than second grade on all the lists from A to F except B and C, they did about grade two and a half on I and L and less than third grade on O. The IX-year olds made grade II in list E, less than grade III on O, grade III on I and L, and IV on F. The results for ages X and XI may be ignored because of the limited number of pupils. Moreover, the low scores in Age X are due to the special peculiarity of the pupils. These boys ranked among the brightest in the special schools, they were merely backward in general intelligence but practically imbecilic in spelling and reading. They were diagnosed at the time of the intelligence examination as cases of dyslexia who were slightly backward in general intelligence.

One of these boys, case Ten (born in Missouri) at the age of 11.08 was backward .4 year from the upper base (X) and 1.6 years from the lower base (VII) by the 1911 B.-S. scale. By the Seguin form-board he graded 10.5 years by the combined norms, and about 9.5 by the writer's norms. The school record indicated that he had been in school four and a half years at the time of the clinical examination in May, 1916, and had advanced to II³. His greatest interest was reported to be centered in "out door life." He was said to have "no ability in any line," but was reported poorest in reading and writing, and somewhat better in arithmetic, was often morose, sullen and inattentive. No delays were reported in his early development. He was said to have cut his first tooth at five months, the fontanelle closed at 1 year (very early), he sat unsupported at five months, stood at nine months, walked and used single words at 12 months, used short phrases at 18 months, but he seemed somewhat stupid at about the sixth year. He had had whooping cough at 2 years, chicken pox at five, and measles at six. He was the thirteenth child, five brothers and five sisters being alive, four brothers had died and one child was born premature. The family history was reported negative. The physical examination indicated anterior nasal obstruction, conjunctivitis, weakness of the left ankle, a neurotic condition, and the advisability of a blood examination. He was very poor in reading, requiring 2 minutes 30 seconds to read 16 words in the VIII-year selection‡ and misreading most of these words. He reproduced four

*Gray, William S. Reading, in Vol. II, Part 4, of the Survey of the St. Louis Schools, 1917, p. 117 f.

†The score for III², 46, strangely, is lower than the score for II⁴, 47. The differences between the scores of the different grades in the St. Louis Survey are frequently so small that it is questionable whether the scale measures with sufficient fineness.

‡Reproduced in Experimental Studies of Mental Defectives, 1912, p. 130.

memories. He tested very unevenly by the B.S. scale. He failed on all except No. 41 in IX but passed all except No. 47 in X and No. 55 in XI. He wrote very well from copy, but the dictation of "the pretty little girl," produced "*The pamy little girl*," in 24 seconds. In June, 1917, the report from the special school showed that he was capable in formal motor and mental games, enthusiastic in physical games, painstaking in woodwork, fair in writing, in the four processes and in problems in arithmetic, but he graded only about I⁴ in reading. He tired quickly, but was quick at observation, was cheerful, gentle, kind, exemplary in conduct, was considered "superior to the average child coming to the special schools," and it was predicted that he "will make good when he goes to work." In the June, 1918, report,* he was reported enthusiastic in physical games, fair in mental games, good in calisthenics, very capable in woodwork although tiring quickly, he has considerable talent in drawing, does third grade work in arithmetic, he knows the processes and can comprehend the problem work, but is poor in spelling (about second grade), although he tries hard to learn two words a day, and poor in reading (second grade), he fails on the simplest words, he is fair in oral language, but poor in written language, owing to inability to spell. His best work is in manual training, while his greatest improvement has been in woodwork. In the standardized educational tests given during the winter and spring of 1918, he did best in the arithmetic exercises. The following indicates the approximate grades which he made in these exercises, in terms of the St. Louis standards.

Test	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Grade .	-III ²	III ²	-III ²	-III ²	-III ²	-III ²	-III ²	-III ²	-III ²	+III ⁴	+III ⁴	III ²	III ⁴	III ⁴	IV ²

It should be explained that the scores in some of the tests cannot be very accurately located because of lack of norms for the second or third grades, but the grading varies from somewhat less than III² (indicated by minus sign) to grade III⁴. He failed completely on N and O, but so did the normal third grade pupils on N and the fourth grade pupils on O. In Gray's oral reading test, on the other hand, he did decidedly poorer, making only 22.5 points, which is considerably below the I⁴ standard (38). The same weakness appears in the standardized spelling test. In Ayers I, L and O he scored 40%, 25% and 0%, respectively, which is markedly below second grade standard, while in Starch's first list he made only 12%, a trifle better than first grade (10%) and in the second list only 8%, or less than the first grade. Here we find, then, evidence of special weakness in reading and spelling which we attribute to dyslexia, i. e., a weakness affecting visual images of words which makes it very difficult to teach the child to read. This child is in no sense to be classed as a mental defective in spite of his very low status in the literary subjects, which is decidedly lower than his general intelligence level. We have examined scores of similar pupils who have been assigned to special schools for mental defectives, but who, rather, should be assigned to ungraded classes for the borderline or the backward, or possibly better still to classes for pupils with dyslexia.

The other boy (case Eleven, born in St. Louis), somewhat more backward mentally at the time of the examination, should also be considered as a case of dyslexia, rather than of feeble-mindedness. His record is as follows:

*On our form 13-G. On this form an elaborate report is made annually of pupils sent to special schools.

At the time of the clinic examination, May, 1917, age 13.4, he had been in school 7 years, half of which time had been spent in a special school from which he was reported for examination. According to the 1908 scale he was backward 2.6 years and according to the 1911, 3. years, the I. Q.'s being .80 and .77. According to the Seguin form board he graded a little over 9 years by the combined norms and less than 8 by the writer's norms (we shall see that he deserves a higher rating by the practical school tests). He was somewhat overdeveloped in sitting and standing height, weight, spirometry and grip. He spoke with a distinct lisp. The results from the physical examination were negative. He required 4 minutes 6 seconds to read the VIII-year old B.-S. selection, but had to be given much aid to get through. His reading was halting and mechanical. He could not read "water" or "street." But he was able to reproduce seven memories. Our first report from the special school in June, 1916, showed that he was excellent in calisthenics and corrective physical exercises, he had made very considerable improvement in "advanced construction" in woodwork, he was very fine in metal work, he showed great skill in advanced basketry, and great accuracy and skill in loom knitting and in knitting caps and scarfs, he had made some improvement in speech, in arithmetic he did third grade work and had advanced about half a year during the school year, he was good in oral language but had little power in reading, in which he had made only slight improvement. In the next report, June, 1917, he was said to have made great improvement in physical training, was excellent in mental games, very good in rhythmic exercises and in floor, balance and suspension exercises, very good in basketry, loom knitting and gardening, good in design drawing, good in oral language, good in arithmetic, doing IV² work, good in problems but easily confused, was improving in writing, and was poor in reading and spelling, doing only about II². His best record was in manual work. He was observant, and capable of logical memory. In the June, 1918, report, he was reported alert, accurate and enthusiastic in physical games, excellent in calisthenics, corrective exercises, woodwork and copper, good in chair caning, and writing, very fine in arithmetic, doing fourth grade work, improving in reading, but still poor, and very poor in both oral and written spelling. He is honest, well-behaved, pleasant, and co-operates nicely.

In the standardized arithmetic tests given in 1918, he graded as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Test Grade	-III ²	+III ²	+III ⁴	-III ²	+III ²	IV ⁴	+III ⁴	-III ²	-III ²	-V ²	IV ⁴	III ⁴	+III ²	III ⁴	-VI ⁴

In these tests he grades from about third grade to fifth and sixth grade. The total failure on the easier fraction test (H) while he made VIth grade in the more difficult fraction test (O), is explained by the fact that he only attempted the addition of fractions in the left hand column of H, and failed entirely on this process (he added the numerators and the denominators), while in O he attempted three additions, two subtractions, three multiplications and one division, and succeeded with the processes of multiplication and division. In other words, he could multiply and divide, but not add or subtract fractions. On the other hand, in the reading test he was barely equal to I⁴, earning 37.5 points, while in Ayres I, L, and O he only made 10%, 10%, and 0% respectively, which is decidedly less than second grade, and in Starch I and II 5% and 19% which, respectively, is equal to less than first grade and between first and second grade. Our school reports confirm the conclusion that this boy's progress in the literary work has been seriously retarded by his special weakness in reading and spelling.

In both of the above cases the bad spelling is primarily due to dyslexia. The relation of dyslexia, (of which "visual aphasia" or "alexia" or "visual verbal amnesia" are extreme degrees) to poor spelling has not yet been adequately studied. Had the cases reported in the literature of bad spellers been adequately analyzed psychologically, it is probable that many could have been resolved into cases of dyslexia or visual aphasia.*

In order to make out a case of "pure" spelling disability we would have to rule out the factor of dyslexia or lack of ability in reading, deficiency in intelligence so serious that the subject would be incapable of forming the associations involved in spelling, and doubtless other factors yet to be determined by the psychological analysis of individual cases. Among the pupils examined in the clinic whom we diagnosed as high-grade deficient but not as cases of dyslexia, we find a number who made unusually low scores in the spelling tests. Had we examined intellectually normal children without dyslexia we might have found similar records in spelling. The records of eight of these pupils, varying in general intelligence from morons to backward cases, is as follows:

Case No.	Sex	Age at time of		B-S. Age	Ret'd	I.Q.	Diagnosis	Yrs. in School	Ayres' Lists						Starch's Lists	
		Spell. Test	B-S. Exam.						D %	E %	F %	I %	L %	O %	I %	II %
Twelve.....	G.	11 0	12 1	7 6	4.5	.63	Mor. ¹	4 8	...	...	...	25	5	5	5	6
Thirteen.....	B.	13 7	12.	8.	4.	.66	Mor. ²	6 1	44	11	16	...	...	...	1	4
Fourteen.....	B.	14 3	12.2	7.4	4.8	.60	Mor. ³	8 3	55	52	33	...	...	...	1	7
Fifteen.....	B.	11 2	8 0	6.6	1.4	.82	Bor. ⁴	5	0	6	5.5	...	...	...	1	1
Sixteen.....	B.	8 2	8 0	6.5	1.5	.80	Bor. ⁵	3 4	0	17	5.5	...	...	...	2	1
Seventeen.....	B.	8 1	8 3	6.	2.3	.72	P.F.-M. ⁶	3 7	11	29	16	...	...	...	0	1
Eighteen.....	B.	12 8	9 6	8.	1.6	.82	Back. ⁷	5 2	44	81	44	...	...	...	5	3
Nineteen.....	B.	12 9	10 2	7.6	2.6	.74	Def. ⁸	6 9	...	...	...	10	5	0	3	5

¹American. ²French descent. ³Italian descent. ⁴German-Irish; restless. ⁵German descent; lis-per. ⁶Potential feeble-minded Jew, born in Russia. ⁷Bohemian-American; speech obstruction. ⁸German descent. All were born in the United States, except number Seventeen. Numbers Twelve, Sixteen and Seventeen were tested by the Stanford scale, which grades lower than the old scales.

Although these pupils ranged from eight to fourteen years of age, and had been in school from three and a half to eight years at the time of the spelling test, and no one graded less than six years mentally at the time of the B-S. examination, no one did even approximately first grade work in the Starch lists, while all did decidedly less than second grade work in the Ayres lists, how much less the inadequate norms do not permit us to determine. It is noteworthy that all these pupils except one were of foreign descent, but all were born in America except one. Possibly the constant use of a foreign language in the home may have something to do with the pupils' poor spelling. Not more than one of these pupils was able to make any score in Gray's reading test. Subject Nineteen scored 33.7, which is below first grade standard. While weak in spelling these pupils, therefore, were also very deficient in reading. Of the pupils who were given the arithmetic exercises, number Twelve scored 6 examples in A and one in E; case Eighteen scored 9 in A, 8 in B, 4 in C, 2 in D, 3 in E, one in F and 2 in J; case Seventeen scored 2 in A, and case fourteen one in A and one in E. Not more than one subject scored in more than two tests, while practically all the scores were markedly below the lowest norms supplied, III². It is evident that these pupils were very deficient in arithmetic also, but the restricted norms do not enable us to determine whether the deficiency is as great as in spelling and reading. Never-

*Since the above was written a special study of spelling disability has been published: Hollingworth, Leta S. *The Psychology of Special Disability in Spelling*, 1918, p. 105. This is a critical psychological analysis of a number of bad spellers.

theless, these pupils were weaker in spelling, and also in reading and arithmetic than many other pupils of the same intelligence level and the same amount of instruction. The average I. Q. (.72) of this group of poor spellers was actually higher than the I. Q. (.68) of the group of good spellers on p. 25, but they had been in school about a year less (5.4 years versus 6.7). Although spelling ability is probably a function of general intelligence in the majority of cases, the foregoing analyses show that among sub-normal children the exceptions are so marked that no prediction could be made from general intelligence level regarding the spelling ability of even a pupil who has received adequate instruction.

When the results are averaged for all the pupils who had been examined in the clinic (Table II), the scores are below second grade in columns A to F, somewhat better than second grade in I and L, and decidedly below third grade in O. Although the medians, Table III, tend to be somewhat higher than the averages the differences are not sufficiently marked to justify detailed analysis.

All the imbeciles, potential morons, morons, potential feeble-minded and borderline failed to reach the second grade standard in columns A to F—many of the scores are markedly below the second grade standard—while the backward reached the second grade standard in only A and B and the “deferred” cases in only A. In column I less than second grade work was done by the potential morons and deferred, second grade work was done by the imbeciles, morons and backward, and third grade work by the potential feeble-minded and borderline. In column L, the imbeciles, potential morons and deferred did not reach second grade, the morons, potential feeble-minded and backward reached second grade, while the borderline fell somewhat short of third grade. In column O the pupils in every classification fell decidedly below the third grade norms, how much below the limited norms do not permit us to determine.

With the first Starch list, the scores were inferior to grade I in our first grade, equal to about grade one and a half in our second grade, somewhat less than grade II in our third grade and somewhat less than grade IV in our fourth grade. The results in the second list are somewhat better than in the first list in the first, second and third grades, and a trifle poorer in the fourth grade.

In the B.-S. classification the averages in ages IV and V are decidedly below grade I in both columns, in age VI they are approximately equal to grade I, in age VII perceptibly better than grade I—perhaps equal to grade one and a fifth—in age VIII about midway between grades I and II, in age IX somewhat below grade II, while the dyslexia cases in X did less than grade I on the first list and somewhat better than grade I on the second list. The scores are uniformly lower for the medians, Table VII.

In Table VIII, diagnosis, the scores vary from less than grade I to about grade one and a half. Only among the morons, borderline and backward in list I, and the morons, borderline, backward and potential feeble-minded in list II are the scores superior to grade I, but the best averages, for the borderline in lists I and II, are only equal to about grade one and a half.

It is obvious from the above results that the Starch scale grades the pupils perceptibly lower than the Ayres scale, although, unfortunately, we cannot assign any definite grading to anyone doing sub-second work by the Ayres scale. Nevertheless, in columns I, L and O of the Ayres list, some of the scores are equal to the third, fourth, fifth and sixth grade standards both in the table where the figures are arranged according to grade and in the table where they are arranged according B.-S. age. In the diagnosis table, however, only the borderline approximate the third grade standard in lists I and L.

VARIABILITY IN SPELLING ABILITY

Practically all educational tests have shown a very large variation in the attainments of children classified in the same grade. Frequently the overlapping extends through four or five grades. Some children in the primary grades may do as well as the average in the upper grammar grades, and some pupils in the grammar grades may do no better than many pupils in the primary.

To show in detail how subnormals vary in spelling proficiency it would be necessary to present complete tables of the distribution of the scores in the grade, B.-S. age, and diagnosis classifications. This, however, would be impracticable here, both because of the expense and the space required to print the data. We are obliged to restrict ourselves, therefore, to tabulating the distribution of the scores for column I of Ayres and for columns I and II of Starch in one B.-S. age, and to presenting the range (R) and the quartile deviation (Q) of the scores, both of which furnish measures of absolute variability. The quartile deviation, sometimes called semi-interquartile range, represents half of the middle half of the measures when arranged according to size, and is found by the following formula: $Q = \frac{Q_3 - Q_1}{2}$ where Q_3 and Q_1 are points on the scale above which three fourths and one fourth of the measures fall. The quartile points are computed by the same method as the median, which is the second quarter or quartile point. The data presented will be confined to the classification according to B.-S. age.

TABLE IX
DISTRIBUTION OF SCORES IN COLUMN I OF AYRES SCALE
ACCORDING TO B. S. AGE

Sex	No. Words	1-5	6-10	11	12	13	14	15	16	17	18	19	20
Age V													
Boys.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1
Girls.....	2	.....	1	.....	.....	.....	.....	.....	1	.....	.....	.....	.....
Both.....	4	.....	1	.....	.....	.....	.....	.....	1	.....	.....	1	1
Age VI													
Boys.....	11	2	2	.....	.....	.....	1	.....	1	.....	1	.....	4
Girls.....	5	.....	.....	.....	.....	1	.....	1	2	.....	.....	.....	1
Both.....	16	2	2	.....	.....	1	1	1	3	.....	1	.....	5
Age VII													
Boys.....	15	.....	4	1	.....	1	1	1	2	1	1	1	2
Girls.....	13	1	1	1	.....	1	.....	3	1	2	1	.....	2
Both.....	28	1	5	2	.....	2	1	4	3	3	2	1	4
Age VIII													
Boys.....	28	..	3	1	2	1	2	2	3	1	2	4	7
Girls.....	10	.....	1	.....	.....	1	1	2	2	.....	1	2	1
Both.....	38	.....	4	1	2	1	3	4	5	1	3	6	8
Age IX													
Boys.....	4	.....	.....	.....	1	.....	.....	.....	.....	.....	1	1	1
Girls.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
Both.....	5	.....	.....	.....	1	.....	.....	.....	.....	.....	1	1	2
Age X													
Boys.....	2	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Age XI													
Boys.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1

Table IX shows what an enormous variation there is in spelling ability between pupils of the same or different B.-S. ages. While one pupil in the IV-year classification (shown in Table II) spelled all the 20 words, one X-year old spelled only two words and another only eight. The VII-year olds spell all the way from 5 words to 20 words. There is extensive overlapping in most of the ages in which there are enough subjects to justify comparison.

TABLE X
DISTRIBUTION OF SPELLING SCORES IN AGE VI OF STARCH'S SCALE

LIST I				LIST II			
Boys		Girls		Boys		Girls	
No. Pupils	No. Words	No. Pupils	No. Words	No. Pupils	No. Words	No. Pupils	No. Words
2	0	1	0	4	1	1	1
4	1	1	1	2	2	1	2
2	2	2	2	1	4	1	4
1	3	1	5	2	5	3	5
2	4	2	10	3	7	1	13
4	5	1	11	2	8	1	16
1	6	1	16	1	9	1	18
2	7	2	18	1	10	1	20
2	10	1	26	3	11	2	22
1	15	1	29	1	12	1	30
1	18			1	15		
1	21			1	16		
1	36			1	19		
1	43			1	25		
25		13		1	33		
				1	35		
				26		13	

In Table X, which gives the distribution for the Starch lists in B.-S. age VI, the boys vary in column I from no words spelled correctly to 43 spelled correctly, and the girls from no words to 29, while in column II the boys vary from 1 to 35 words and the girls from 1 to 30. In these lists many V-year olds spell just as well as many VIII-year olds.

TABLE XI
THE Q AND R (RANGE) FOR THE AYRES SCALE ACCORDING TO B.-S. AGE

Sex	B		C		D		E		F		I		L		O	
	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R
Age IV																
Boys																
Girls	0	3-4	0	4-7	2	1-7	6	2-14	5.5	0-14						
Age V																
Boys	.5	0-4	1.5	2-7	2.5	0-8	5.5	1-16	6.5	0-15		19-20		11-16		13-19
Girls	1.5	1-4	1.5	3-7	3	0-7	4.5	1-15	3	1-15		10-16		8-14		1-2
Both	1.5	0-4	1.5	2-7	2.2	0-8	5	1-16	6.25	0-15	2	10-20	2.5	8-16	8.5	1-19
Age VI																
Boys	1	0-4	1.5	0-7	2.5	0-9	4.75	0-16	5	0-18	5.5	2-20	6.25	1-19	5.75	0-18
Girls	1	1-4	1	1-7	1.75	0-9	5	1-17	6.5	0-18	2	13-20	4	5-20	2	1-6
Both	1	0-4	1	0-7	2	0-9	4.5	0-17	5.5	0-18	3.5	2-20	6	1-20	5	0-18
Age VII																
Boys	.5	1-4	1	2-7	1.5	0-9	3.5	1-17	4.75	0-17	3.75	6-20	5	2-17	3.75	0-11
Girls	0	0	0	5-7	1.5	0-9	1	12-15	2.5	4-15	2.25	5-20	3.5	1-20	2.25	0-12
Both	.5	1-4	1	2-7	1.5	0-9	3.5	1-17	4.5	0-17	3.5	5-20	4	1-20	2.5	0-12
Age VIII																
Boys	0	3-4	0	5-7	1	4-9	1.75	11-16	4.25	9-18	3	9-20	5	3-20	3	1-20
Girls								13-15		12-17	2	6-20	3.5	2-19	2.75	1-16
Both	0	3-4	0	5-7	1	4-9	1.5	11-16	4	9-13	2.5	6-20	4.75	2-20	3	1-20
Age IX																
Boys											1	12-20	3	4-19	2	4-8
Girls																
Both											1	12-20	2.75	4-19	3.25	4-11

Table XI gives in detail the range of scores (R) and the quartile deviation (Q) in each B.-S. age for the Ayres columns. Confining our analysis to the results for both sexes combined for the five most difficult lists, we find that in column E, which contains 17 words the largest range is from 0-17, or 17 words, in age VI, and the smallest from 11-16, or 5 words in age VIII. The smallest Q is 1.5 words in age VIII, and the largest 5.25 in age IV. In age VIII the Q amounts to 9% of the number of words attempted, while in age IV it amounts to 30%.

In column F, which contains 18 words, the greatest range is 18 words, in age VI and the smallest 9 words, in age VIII. The Q varies from 6.25 words in age V, or 34% of the number attempted, to 4 words, or 22%, in age VIII.

In column I the greatest range is 18 words, in age VI, and the smallest 8, in age IX, while the largest Q is 3.5 words, or 17% of the 20 words attempted, in ages VI and VII, and the smallest 1 or 5% in age IX.

In column L, the greatest range is 19 words, in VI and VII, and the smallest 8, in age V, while the largest Q is 6, or 30% of the 20 words attempted, in age VI, and the smallest 2.5, or 12%, in age V.

In column O the greatest range is 19 words, in age VIII, and the smallest 7 words in age IX, while the largest Q is 8.5 words, or 42% of the 20 words attempted, in age V, and the smallest 2.5, or 12%, in age VII. While the variation is usually very considerable with the common Ayres words, it is even greater with the chance Starch words.

TABLE XII

THE Q AND R (RANGE) FOR THE STARCH SCALE ACCORDING TO THE B.-S. AGE

Sex	List I		List II	
	Q	R	Q	R
Age III				
Boys.....	.5	0-3	2.	3-7
Age IV				
Boys.....		1-4		5-11
Girls.....		1-2		2-5
Both.....		1-4		2-11
Age V				
Boys.....	3.	2-11	4.25	0-14
Girls.....	6	0-16	5.	1-16
Both.....	3.	0-16	4.	0-16
Age VI				
Boys.....	4.	0-43	4.5	1-35
Girls.....	7.5	0-29	8.25	1-30
Both.....	7.	0-43	7.	1-35
Age VII				
Boys.....	5.25	1-29	6.	20-31
Girls.....	7.75	5-46	5.75	6-37
Both.....	4.5	1-46	5.5	0-37
Age VIII				
Boys.....	6.25	4-55	9.25	5-46
Girls.....	6.75	3-45	7.25	10-51
Both.....	7.5	3-55	7.	5-51
Age IX				
Boys.....	9.	20-39	6.	20-37
Girls.....		22-30		23-29
Both.....		20-39		20-37
Age X				
Boys.....		5-12		8-19

Based on the averages for the two sexes the greatest range in list I, Table XII, is 52 words, in age VIII, and the smallest three words, in ages III and IV; while the largest Q is 7.5 words, in age VIII, and the smallest .5 in age III. In list II the greatest range is 46 words, in age VIII, and the smallest 4 words, in age III, while the largest Q is 7, in ages VI and VIII, and the smallest 2, in age III. The small variations in ages III and IV are due, of course, to the inability of these pupils of low mentality to spell many words. We cannot accurately express the Q's in terms of per cents of the number of words given, for the number of words given varied with the grade, and the B.-S. ages and the grade tabulation, of course, do not correspond.

GENERAL CONCLUSIONS

- 1 The improvement in spelling efficiency in the Ayres lists with increasing grade, increasing Binet-Simon age and increasing intelligence classification is not very marked nor is it always consistent. The irregularities and exceptions in the curve of improvement are due to a number of factors: the selection of the best spellers among the low grade pupils, the restriction of the testing of many pupils to only a few columns, some pupils not being given enough of the harder columns and some not enough of the easier; the difference in the chronological age, and the amount of time spent in school by the children in the different groups; the presence of especially weak or especially strong spellers in unequal proportions in the different groupings; and the limited number of pupils in some classification. It is also possible that there may be inaccuracies in the grade classification, as the grouping was based on the teacher's classification of the pupils in reading. However, the improvement from grade to grade was greater for the subnormal than for the normals in some columns, but less in others. Thus in column I, using the percentage figures, the subnormals made no improvement from second to third grade, while the normals in Ayres tabulation increased 20%. The subnormals did 4% better in grade IV than they did in grade III, while the normals did 9% better. On the other hand, in list L, the subnormals did only 10% better in grade III than they did in grade II, as compared with 46% for the normals. In grade IV, however, the subnormals did 55% better than in grade III, while the corresponding figure for the normals is 25%. In making these comparisons it should be remembered that the absolute scores of the subnormals were frequently considerably lower than the scores for the normals in the corresponding grades.
- 2 The improvement with increasing grade, Binet-Simon age and diagnosis is more emphatic and more consistent in the Starch lists, although here, too, many of the disturbing factors enumerated above are also operative. In these lists the improvement from grade to grade is about as large for the subnormals as for the normals, amounting for the former to 163%, 44%, and 27% for grades I to IV, and for the latter to 200%, 33%, and 27%.
- 3 The rating of the relative spelling proficiency of these pupils in terms of normal standards differs in the Ayres and Starch lists, while the variation in the rating by the different Ayres lists is surprisingly great. The rating by the Starch lists, however, corresponds more nearly with the achievement of these pupils in the Gray oral reading test and in the special arithmetic exercises.

The Ayres lists do not afford a very satisfactory instrument for rating mental defectives or pupils in the lowest grades in spelling, both because of the lack of standards in the lower grades and the lack of standards for scores falling below 50%, and because of the great difference in rating obtained from the different columns of words.
- 4 Our highest group of the feeble-minded, the morons, did not, on the average, do better than second grade work in Ayres' lists nor above grade one and a half in Starch's lists, after having averaged about six years in school. In other words, our highest grade of mental defectives required about 3 years to do one year of work. Of our best individual spellers among the mental defectives only one did better than grade III in Ayres list O and only one did third grade work in one of Starch's lists.

The practical bearing of our conclusion of interest to school administrators is that very few children doing work above the second grade in spelling

should be assigned to special classes for the feeble-minded. Children in such classes doing work above the second grade should be very carefully examined to determine whether they are feeble-minded. If they are not they should be transferred to properly organized ungraded classes if such classes are available.

It should be remembered that the conclusions set forth in this and the two following chapters with respect to the possible educational attainments of feeble-minded children are based on the results obtained in a school system in which the vast majority of these children withdrew from school on becoming fourteen years of age. The level of educational attainment in the literary branches would probably have been somewhat higher had the children been retained two or three years longer.

- 5 The question naturally arises whether society is justified to spend so much time, money and effort on a form of instruction which yields such meagre results. It may be asked whether it would not be wiser to devote the time expended on spelling to forms of training which produce higher returns. We may say at once that the effort spent in teaching spelling to the lower grades of imbeciles is wasted, and possibly the same conclusion is justified with respect to the highest grades of imbeciles. However, it would not be advisable to give no instruction in spelling to the higher grades of young imbeciles, because the degree of possible mental development cannot always be accurately foretold in the early life time of mental defectives. Many who at the time of the examination test as imbeciles of the higher grades will eventually reach the status of morons.

So far as concerns the morons, it would not be feasible nor wise to eliminate all instruction in spelling. In the first place, most parents would demand that the child be given this instruction, and if it were not given in the special school they would insist on the transfer of the child to a regular grade. In the second place, these children eventually gain a slight degree of mastery of a tool which enables them to read simple subject-matter, and to express themselves to some extent in writing. This achievement, however modest, enables the individual to escape the stigma of complete illiteracy, and gives him partial control of a process which will give him some pleasure and will be of some service to him in his after career. Society will probably be willing to bear the burden of the expense, if a slight mastery of spelling makes the mental defective a little bit more contented, human, and efficient. It is evident, however, that too much time should not be devoted to making the mental defective proficient in a form of social accomplishment in which he can never become proficient, especially when this is done at the sacrifice of more profitable forms of training.

- 6 The variability in spelling ability among mental defectives is very considerable. We are unable to say from data so far published whether variability is greater among mental defectives than among normals. Even if the data were available for normals, the results would be more or less equivocal, because frequently the classes of "normal" children contain mentally retarded children, some of whom may be actually feeble-minded.
- 7 The distribution of spelling ability doubtless in general follows the bell-shaped curve, among mental defectives and among subnormal as well as among normal children. While the mental defectives and subnormals occupy the lower end of the curve, the form of the curve of distribution of spelling abilities within this segment is probably the same as the form of the curve in the

higher segment for normal children. We have found mental defectives, just as we have found normal children, who have special ability in spelling, while others have special disabilities in spelling, but not one of the subnormals tested was a spelling prodigy. Although these variations may often be regarded as "natural variations," it is evident that spelling ability depends upon many factors,* and that the reasons for the variations may differ in different cases.

- 8 Some of our cases of "chronically" poor spelling were due to alexia or dyslexia. It is important always to determine whether this factor is operative when studying poor spellers, because these cases, so far as we now know, constitute the most refractory type of spelling disability. Doubtless many poor spellers among children of normal intelligence are unrecognized cases of dyslexia.
- 9 There is doubtless in general a fair degree of correlation between spelling ability and general intelligence, but this correlation is not sufficiently close to make it possible to make any definite prediction in regard to an individual's spelling ability, even when his intelligence status and his scholastic advantages are known. Two of our most intelligent pupils were among our poorest spellers. In their cases the special spelling disability was due to dyslexia. Doubtless other factors will explain special spelling variations among children of the same intelligence level (and stage of instruction).

There are many who at present believe that children should be classified according to their intelligence age as determined by a measuring scale of intelligence. Much may be said in favor of this proposal for children without special abilities or disabilities. But when children have special defects or talents we cannot rigidly adhere to such a scheme of classification.

- 10 There is no clear difference in our results between the spelling ability of boys and girls among subnormals. Possibly the girls may be slightly superior. Satisfactorily to evaluate our results it would be necessary to compare the intelligence and chronological ages of, and the amount of time spent in school by, the boys and girls in corresponding classifications. These data are available in the tables, with the exception of the intelligence ages (the grouping, however, in some of the tables is based on the intelligence age). So far as concerns the averages for the entire group of boys and girls, the average chronological ages are practically the same in Tables I and II for the boys and girls, while the boys had been in school slightly longer. In Table V the girls average slightly older, while the time spent in school was the same. The conditions in regard to age and amount of schooling are almost the same for the two sexes.

*The most recent analysis has been made by Hollingworth, as above.

CHAPTER II

THE ACHIEVEMENT OF SUBNORMAL PUPILS IN THE GRAY ORAL READING TEST

All the pupils were tested alone in quiet rooms in the regular special school buildings by Miss Alice Lachmund, in the interim between April 17 and May 8, 1918. The timing was done by means of a stop-watch, and the records were scored in accordance with the instructions contained on the reverse side of the record blank. However, the instruction under 2.b, "to enter the total score for each paragraph in the column under 'Score' is applied to 3., finding the individual scores, and should be corrected in the future editions. The grade classification of the pupils in reading was made by the pupils' classroom teachers.

Of the 304 pupils given Gray's test, 161 had been tested by the old B.-S. scale and 75 by the Stanford. The 65 who had not been tested had been admitted to the special schools before the clinic was established. The number of pupils enrolled on April 26 was 380, so that approximately 75 pupils were not given the reading test. Some of these pupils were absent, but many were not tested because the classroom teachers reported that they were incapable of reading. Of 28 who were present and who had been examined in the clinic, but who were not given the test because they could not read, 21 had been classified as imbeciles, 2 as potential morons, 1 as moron, 2 as borderline and 2 as "deferred." However, a considerably larger proportion of the pupils present were tested in reading than in spelling or arithmetic, obviously because more attention has been given to the teaching of reading to these children than to the teaching of either number or spelling. Reading is the most important of the literary branches taught not only in the special schools but also in the elementary schools.

THE RELATION OF ACHIEVEMENT IN READING TO ASCENDING SCHOOL GRADE, B.-S. AGE, AND DIAGNOSIS

The analyses will be restricted to the averages for the two sexes, including the medians in the tabulation according to B.-S. age.

Only three pupils classified as of kindergarten grade, Table XIII, were given the reading test, all failing to make any score. Two of these pupils had been examined in the clinic.

TABLE XIII
ORAL READING TEST ACCORDING TO GRADE

Sex	No.	Chron. Age at Time of		B.-S. Age	Yrs. in School	Score	Number and Average
		B.-S. Test	Read. Test				
Kindergarten							
Boys	3	2	3	2	2		Number
Boys		8.5	10.91	5.7	3.45		Average
Grade I							
Boys	117	101	116	102	99		Number
Boys		10.09	11.43	6.5	4.4	5.51	Average
Girls	47	43	47	43	43		Number
Girls		10.04	11.61	6.23	4.23	7.76	Average
Both	164	144	163	145	142		Number
Both		10.08	11.48	6.42	4.35	6.15	Average
Grade II							
Boys	55	37	55	36	36		Number
Boys		11.31	13.04	8.17	6.36	31.08	Average
Girls	32	22	32	22	22		Number
Girls		11.73	13.03	7.37	6.33	35.44	Average
Both	87	59	87	58	58		Number
Both		11.47	13.04	7.87	6.35	32.69	Average
Grade III							
Boys	29	18	29	18	18		Number
Boys		12.44	13.81	8.4	6.74	40.12	Average
Girls	17	9	17	9	9		Number
Girls		12.08	14.33	7.86	5.21	40.36	Average
Both	46	27	46	27	27		Number
Both		12.32	14	8.22	6.23	40.21	Average
Grade IV							
Boys	3	3	3	3	3		Number
Boys		13.42	14.69	10.03	7.01	47.91	Average
Girls	1	1	1	1	1		Number
Girls		13.25	14.66	8.66	7.66	42.5	Average
Both	4	4	4	4	4		Number
Both		13.37	14.68	9.69	7.17	46.56	Average
General Averages for all Grades							
Boys	207	161	206	161	158		Number
Boys		10.68	12.23	7.14	5.15	17.69	Average
Girls	97	75	97	75	75		Number
Girls		10.82	12.58	6.79	5.01	22.96	Average
Both	304	236	303	236	233		Number
Both		10.73	12.35	7.03	5.11	19.37	Average

For explanation of tables see Table I.

Case Twenty was first examined in the clinic January, 1915, age 7.3, having been one year in the kindergarten and one quarter in the first grade. The school reported that he had not shown any special interests or capacities, that he had made no progress "compared with children a year younger," that he was excellent in conduct, and that he had one brother and one sister, aged 8 and 10, both in school and both poor in their school work. The developmental history indicated that he was the third child, born of American parents, age 23 (mother) and 28 years at the time, that his birth was one month premature, that he was delivered with instruments, after a very difficult labor, that he was yellowish at birth and weighed six pounds but that he was healthy as a baby, and that he had measles at two years, from which, however, he recovered completely. He showed no developmental retardations. He cut his first tooth and sat at 6 months, stood at 9 months, took his first steps unsupported at 11 months, and expressed himself in short phrases at 9 $\frac{1}{2}$ months (the mother was not very certain about the accuracy of the latter statement). He talked and walked earlier than his sister. He was a "quiet, good boy," although he had always been "nervous." No significant facts were obtained from the family history. The physical examination

only revealed the presence of dental caries and a bulging forehead. By the 1908 scale he was backward 1.5 years and by the 1911, 1.7 years (I. Q. .75), while by the Seguin form board he was backward 1.8 years by the combined norms and over 3 years by the writer's norms. He was able to read a few monosyllables by sight. His head girth was not quite equal to a 6-year old boy (20.3 inches), and in standing and sitting height, weight and dynamometry with the right and left hand he fell, respectively, in the fifteenth, fifth, tenth, thirteenth and tenth percentiles for his age. He manifested a distinct lisp in speech, involving particularly the articulation of ch, th, sonant and surd (the latter being correctly pronounced in some words), v, y, z, and g in certain combinations. The diagnosis was deferred, and the recommendation was made that he be given special articulation drills, that he be transferred to an ungraded class for special aid in the regular school work and for careful observation, and that he be re-examined later if he failed to make adequate progress. The school found it possible to carry out the recommendations only in part (no ungraded class was available) and he was referred for another examination in January, 1917, aged 9.3. He had been advanced to the first grade third quarter after three and a half years in school, but was said to do satisfactory work in "no grade or quarter." His greatest deficiency was in reading, his greatest interest in cutting, drawing and coloring, but he did not show any talent in anything. He was reported good in moral characteristics, excellent in disposition and conduct, but "extremely backward." His brother, now age 12, had advanced to IV³, and his sister, now aged 10, to III². He was now retarded 2.9 by the 1908 and 3.1 by the 1911 (I. Q. .66), and 2.8 by the Seguin form board according to the combined norms and over 3 years according to the writer's norms. He was unable to read the monosyllables in the B-S. selection, but could read, although poorly, the material in a primer which he had gone over many times. On the physical side the only defects reported were a number of very bad dental roots. His greatest obvious improvement was in articulation. He spoke much more distinctly than when he was examined two years before. He was diagnosed as an imbecile and assigned to a special school. But the parents protested that he was not mentally deficient and therefore refused to give consent to the transfer. In November, 1917, he was again reported to the clinic, having been demoted to I² after over four years in school. The transfer to the special school was finally effected on the twenty-fifth of the month, with instruction to give the child "a preponderance of sensory, motor, and physical training, the rudiments of the literary branches on a sensory basis, and articulation drills to correct phonetic defects." At the close of the school year, at the age of over ten and a half years and after about five years in school, he was reported as doing good work in physical and sense training games, calisthenics, corrective physical exercises, and knitting, and very good work in clay. He did about I¹ in reading easy sentences from the blackboard, and in spelling words from the day's lesson, less than I¹ in counting and copying figures in arithmetic, and poor work in oral and written language. In oral expression he "has so little voice it is difficult to judge." "He does not care to talk." His greatest capacity is in handwork, and his greatest improvement in reading. He applies himself and is obedient and cheerful. He was not given the Ayres and Starch spelling tests, or the spiral arithmetic exercises.

After five years in school this boy cannot do the literary work as well as a normal child who has been in the first grade less than a year. Certainly from the standpoint of the results the state would be justified in excluding this type of a child, after a fair trial, from attendance in the day schools, or at least largely limit his instruction to simple practical forms of motor and industrial training, and the development of habits of self-care and helpfulness to others. But the parents insist not only that he is entitled

to public school instruction because they are taxpayers, but also that he must be given adequate drill in the literary branches. The educational treatment of pupils of this type presents a social problem which is not easily solved.

Case Twenty-one was examined in the clinic in September, 1916, at age 7.7, having been half a year each in the kindergarten and first grade. He was reported as being "listless and stupid, caring for nothing, and showing no ability." He was said to have had convulsions when quite young. He measured 2.1 years short in general intelligence by the 1908 scale, and 2.5 years by the 1911 scale (I. Q. .67) and 3 years short by the Seguin form board. He was illiterate and subject to a slight lisp, while his facial appearance was distinctly adenoidal. He was assigned to a special school as a moron (or rather potential moron). The first report a month later from the special school indicated that he was "doing nicely" but the second report, at the end of the year, stated that he was "very defective." After two years in the special school, at the age of 9 years and 5 months, the report indicated that he was fair in modeling simple objects in clay, poor in raffia weaving, drawing, writing, arithmetic and reading, doing about I² work in each. His progress, however, was said to have been "greatly retarded by long periods of absence." "He does fairly well when his attendance is regular." He was not given the Ayres or Starch spelling tests or the spiral arithmetic exercises, because the teacher reported that he could do nothing in them. It is evident that this boy has made very slow progress, and that he will prove to be more defective than it at first appeared.

The increase in the "raw" scores from grade to grade, Table XIII, is marked, amounting to 6.15 points from the kindergarten to the first grade, 26.54 points from grade I to grade II, 7.52 points from grade II to III, and 6.35 points from grade III to IV. Paralleling this increase in achievement we find that the chronological age, the B.S. age and the amount of time spent in school increase from grade to grade, except that the third grade pupils had on the average spent slightly less time in school than the second grade pupils. The greatest difference in the amount of time spent in school is between grades I and II, amounting to two years, while the greatest difference in B.S. age is between grades I and II and III and IV, amounting, respectively, to 1.45 and 1.47 of a year. The unusually large increase in the reading score between grades I and II is probably not due solely to the considerable difference in the intelligence level of the pupils in these grades, but to the probability that some pupils classified in the first grade should, instead, have been classified in the kindergarten, or in sub-first. This is suggested by the fact that, although the percentage of gain made from grade to grade is decidedly greater among the pupils in the special schools than among the pupils in the regular grades in St. Louis, the comparative increase from grade I to grade II is preternaturally large among the special pupils. This is shown by the following indices of improvement which were obtained by dividing the score made by the special school pupils in grade I into the score made in grade II, in grade II into grade III, and in grade III into grade IV, while the indices for the pupils in the regular grades were similarly secured by using the scores made in the regular grades:*

Grades	II	III	IV
	I	II	III
Special Classes.....	5.30	1.23	1.15
Regular Classes.....	1.23	1.06	1.04

*These indices are based upon the raw scores. If the basis of scoring for the first paragraph had been the same for all grades, the improvement would have been larger in both groups. We shall again refer to the system of preferential weighting used in scoring the records.

The improvement in grades III and IV among the special school pupils is insignificant compared with the improvement of 430% in grade II compared with grade I. The fact that the relative gain from grade to grade is considerably greater throughout for the pupils in the special schools than for those in the regular grades caused us some surprise, in view of the fact that the chronological age and the amount of time spent in school by the special class pupils increases less than a year except for grade II, while the average mental age increases over a year only in grades II and IV, the latter of which shows the smallest gain. It is probable that the greater percentage of gain made by the subnormal group is due to their very low scores in the lower grades, which makes it possible for them to improve relatively more from grade to grade than the normal pupils. We have already called attention to the fact that because of their low initial scores feeble-minded children improve relatively more from practice in replacing the blocks in the Seguin form board than do normal children. In a number of group tests of intelligence we likewise found that epileptics also improved relatively more than normal pupils from repetitions of the same tests.* We must, of course bear in mind that our group of subnormals and mental defectives average considerably higher in chronological age than the normal pupils with whom we are comparing them.

Turning to the results for the B.-S. ages, Table XIV, all of the six pupils in Age III failed completely in the test, although they had been in school on the average over three years and averaged ten years of age, and although the B.-S. age assigned them did not do them full justice owing to linguistic or other special handicaps. Five of these cases had been diagnosed as imbeciles while the diagnosis was deferred in the other case.

*Psycho-Motor Norms for Practical Diagnosis, 1916, pp. 73-88.

Problems of Subnormality, 1917, p. 378 (we here give, however, only the absolute improvement which is smaller in most tests for the epileptics while the relative improvement is larger).

The Measurement of Mental Traits in Normal and Epileptic School Children (the publication of this manuscript has been delayed because of the present difficulties of publication).

TABLE XIV
ORAL READING TEST ACCORDING TO B.-S. AGE

Sex	No.	Chron. Age at Time of		B.-S. Age	Yrs. in School	Score
		B.-S. Test	Read. Test			
Age III						
Boys.....	6	8.61	10.55	3.54	3.06	.....
Age IV						
Boys.....	4	9.19	10.85	4.4	3.95	.....
Girls.....	7	9.4	11.66	4.35	3.81	2.32
Both.....	11	9.32	11.36	4.37	3.86	1.47
Age V						
Boys.....	17	8.85	10.28	5.42	3.52	2.13
Girls.....	9	8.21	9.21	5.6	3.2	.....
Both.....	26	8.63	9.91	5.48	3.41	1.39
Age VI						
Boys.....	42	9.65	10.90	6.45	4.07*	11.16
Girls.....	21	9.71	11.47	6.32	4.33	11.72
Both.....	63	9.67	11.09	6.41	4.16†	11.34
Age VII						
Boys.....	46	11.19	12.34	7.4	5.66‡	11.82
Girls.....	23	12.47	13.69	7.41	5.94	26.08
Both.....	69	11.62	12.79	7.4	5.76§	16.57
Age VIII						
Boys.....	34	12.03	13.47	8.37	6.56||	29.48
Girls.....	14	12.17	13.44	8.33	6.22	32.85
Both.....	48	12.07	13.46	8.36	6.46**	30.46
Age IX						
Boys.....	9	12.19	13.98	9.27	6.91	28.33
Girls.....	1	11.16	13	9.0	5.5	51.25
Both.....	10	12.08	13.88	9.15	6.77	30.62
Age X						
Boys.....	1	13.4	14.16	10.2	7.9	37.50
Age XI						
Boys.....	1	14.6	14.75	11	6.5	33.75
General Averages for all Ages						
Boys.....	160	10.68	12	7.09	5.15	14.85
Girls.....	75	10.82	12.28	6.79	5.22	18.31
Both.....	235	10.73	12.09	7.00	5.17	15.96

Ten of the IV-year olds also completely failed in the test, six having been diagnosed as imbeciles, one as potential feeble-minded and three as "deferred," while only one pupil, case Twenty-two, scored in the test, 16.25 points (from the first grade base), which is less than one-half of the St. Louis I⁴ standard (38). She was not given the spelling and arithmetic tests. This girl, a Mongolian imbecile, aged thirteen and a half years, who had been seven and a half years in school, who at the age of 11 years (in July, 1915) was 6.4 years backward by the 1908 and 6.8 years backward by the 1911 (I. Q. .38), who was 5.5 years backward by the Seguin form board according to the combined norms and a little over six according to the writer's norms, and whose best times in the writer's peg boards†† were 12.4 seconds in series A, 15 seconds in C and 22 seconds in D.

In physical development she occupied the eighth and fifteenth percentiles in standing and sitting height, the fifth percentile in weight, and the zero percentile in right and left grip, while her head girth was about equal to that of a three-year old child (19.1 inches), with a cephalic index of 82.7 (antero-posterior diameter 162 mm. and transverse

*Based 41 cases. † 62 cases. ‡ 44 cases. § 67 cases. || 33 cases. ** 47 cases.

††The Peg Form Boards. The Psychological Clinic, 1918, pp. 40-53.

diameter 134 mm.). Her lobules were lacking, her lips were thick, the lower one everted, her uvula very long, forehead somewhat bulging, fingers and tongue mongoloid, gait shuffling, speech inarticulate, shoulders stooped and asymmetrical, neuromuscular tone deficient, expression imbecilic, her teeth only partially developed, and palate narrow and low, but flat in the dome. A year later her percentiles were just the same in physical development, while she had gained almost a year in the Seguin form board test. The mother fell down the stairway during the third month of pregnancy, and was very weak at the time of labor, which was long and difficult. The mother was 28 years of age and the father 54 at the time of the girl's birth. An only sibling, an older brother, is paralyzed from infantile paralysis. The girl did not stand alone until three, or walk until four. Only scarlet fever at six years of age is reported in her record of diseases. She is obedient in the home. At the time of the first clinic examination she was able to read a little from a primer in use in the first grade.

We have received four annual reports of the work of this pupil in a special school, but space permits only a brief summary. After over five years in the special school and over two years in the regular school, she was reported as doing second grade reading, and I² spelling. She responds very slowly and only when forced to do so in physical, sense-training and mental games. She is slow in following directions. She is poor in clay work, can knit a little under constant supervision, she is neat and painstaking in huck toweling, she is poor in writing, she reads familiar material well, but has great difficulty in making out new words, her oral expression is very faulty, she prattles constantly when playing but otherwise does not care to talk, she counts but has little conception of number, her greatest improvement has been in reading, she is obedient, willing, and tries, but is phlegmatic, tires easily, and is so timid that she seems to be stubborn.

This child is typical of the lower grades of Mongolian deficient, most of whom remain custodial cases for life. It is to be hoped that the public schools may be entirely relieved of the responsibility of the training of Mongolians of the degree of intelligence possessed by this girl. After all these years of patient tuition the schools have been able to give her very little of economic value. She should have been given simple forms of manumetal work in some institution. It should be said, however, that many Mongolians seem to make more progress in reading than they do in manumetal work. Many are so extremely awkward and clumsy in muscular co-ordination that they never acquire any useful degree of motor skill. They can only perform tasks which require little intelligence and little manual dexterity. This Mongolian pupil, e. g., reads better than many of our non-Mongolians of considerably higher grade of intelligence. This girl did not reach our intelligence standard for entrance or retention in a special school, but we have permitted her to remain partly because of the entreaties of her parents and partly in order to have one of her type and grade of intelligence available for study and for observation by students preparing to work among mental defectives.

The curve of improvement in reading with each increasing B.-S. age, Table XIV, is quite irregular, as shown by the following indices, representing the quotient obtained by dividing the raw reading score of a given B.-S. age into the score of the next higher B.-S. age:

Ages	V	VI	VII	VIII	IX	X	XI
	IV	V	VI	VII	VIII	IX	X
Index.....	.94	8.15	1.46	1.83	1.005	1.22	.90

The gains vary from .005% in Age IX (compared with age VIII) to 715% in age VI (compared with age V), while the losses vary from 6% in age V to 10% in age XI, compared in each case with the preceding age. The loss in age V is probably due to the fact that the pupils average almost a year and a half younger and had been in school almost half a year less than the pupils in age IV. The results for ages X and XI are, of course, unreliable because only two pupils are included, and both of them of very special type. The X-year old is the dyslexia pupil, case Eleven, discussed in the section dealing with the spelling tests. He barely did 1st work in reading. Although he did better than the average in age IX, it must be remembered that most of the pupils in age IX were more retarded mentally, six had been diagnosed as borderline and four as very backward. The dyslexia case was merely backward. As we pointed out before, while he did only about first grade work in the reading and spelling tests he did from third to fifth or sixth grade work in the spiral arithmetic exercises.

The XI-year old boy was also described in the section on spelling (case Two), His low reading score was due to spastic paralysis which produced very difficult and labored articulation. He required from 39 to 175 seconds to read the different paragraphs, which was exceedingly slow for a child of his intelligence.

The medians, Table XV, are decidedly lower than the averages in ages IV to VII and somewhat higher in ages VIII and IX. No comparison is possible in ages X and XI. The big difference between the medians and averages in ages VI and VII is due to the fact that 39 of the 63 pupils in age VI and 33 of the 69 pupils in age VII made zero scores.

TABLE XV
MEDIAN IN READING TEST ACCORDING TO B.-S. AGE

B.-S. Ages	III	IV	V	VI	VII	VIII	IX
Boys.....	.0	.0	.0	.0	.0	36.25	30
Girls.....		.0	.0	.0	31.25	33.12	51.25
Both.....	.0	.0	.0	.0	2.5	35.62	33.75

If we confine the comparison to the imbeciles, morons, borderline and backward, in Table XVI, there is a marked increase from classification to classification, with the exception of the backward group, as shown by the following indices of improvement which have been computed by dividing the raw score in a lower classification into the score in the next higher classification:

Category	Morons	Borderline	Backward
	Imbeciles	Morons	Borderline
Index.....	4.37	1.39	.87

TABLE XVI
ORAL READING TEST ACCORDING TO DIAGNOSIS

Sex	No.	Chron. Age at Time of		B.-S. Age	Yrs. in School	Score
		B.-S. Test	Read. Test			
Imbeciles						
Boys.....	21	9.64	12.31	5.07	3.88	.35
Girls.....	15	10.27	11.99	5.6	4.82	9.5
Both.....	36	9.91	12.18	5.29	4.19	4.16
Potential Morons						
Boys.....	5	10.42	11.28	5.38	3.6	4.75
Girls.....	3	10.46	10.13	5.89	3.95	.41
Both.....	8	10.43	10.85	5.57	3.73	3.12
Morons						
Boys.....	42	11.79	12.75	7.32	5.82	13.83
Girls.....	24	13.14	14.11	7.76	5.87	25.83
Both.....	66	12.28	13.24	7.48	5.84	18.20
Potential Feeble-Minded						
Boys.....	26	9.89	10.34	6.96*	3.59†	11.25
Girls.....	12	10.02	10.76	6.19	4.7	21.25
Both.....	38	9.93	10.47	6.71‡	3.96	14.4
Borderline						
Boys.....	38	10.86	12.48	7.72	6.10	24.17
Girls.....	7	11.57	13.49	7.98	6.38	34.82
Both.....	45	10.97	12.63	7.79	6.15	25.83
Backward						
Boys.....	17	10.47	12.91	8.37	5.87§	25.44
Girls.....	6	8.15	10.54	6.46	3.91	14.16
Both.....	23	9.87	12.29	7.87	5.33||	22.5
Deferred						
Boys.....	12	9.23	11.22	6.1	4.63	10.10
Girls.....	7	9.05	10.73	5.95	3.5	3.39
Both.....	19	9.16	11.04	6.04	4.21	7.78
Normal Girl	1	8.0	9.75	7.8	4.75	2.5

Emphatically the largest improvement is made by the morons compared with the imbeciles, corresponding to the large improvement of the second grade over the first grade, and the sixth intelligence age compared with the fifth, although the gains in the latter comparisons are much larger. The reason the backward did 13% poorer than the borderline may be partly due to the fact that they averaged a third of a year younger in chronological age (while grading a trifle higher in B.-S. age).** The main reason however, is that the backward group averaged almost a year less in school than the borderline. The reason that the potential morons who, in our belief, possessed enough intelligence eventually to advance to the highest grade of mental defectives, did poorer than the imbeciles is probably due to the fact that they averaged a year and a third younger, and had been in school almost a half year less. They averaged higher in B.-S. age, however, in fact relatively higher than indicated in the table, because relatively more of the potential morons than the imbeciles had been examined by the Stanford revision, which grades the subject lower than either the 1908 or 1911. It would seem that the potential feeble-minded who, we felt, would eventually prove to be feeble-minded, should have done better than the morons in the test. The reason they did not do better—they did only about 80% as well as the morons—is probably due to the fact that they averaged 2.77 years younger, had been in school 1.88 years less, and

*Based on 25 cases. †24 cases. ‡37 cases. §16 cases. ||23 cases.

**It is evident that small differences in the intelligence level of different groups cannot be brought out by the usual method of giving mental ages in round numbers, instead of fractional parts of a year, as we have uniformly done.

measured .77 of a year less in B.-S. age. With respect to the intelligence age, however, it should be said that the potential feeble-minded rated relatively higher than the morons as they averaged only 9.93 years of age at the time of the examination, as against 12.28 years for the morons, giving an average I. Q. of 67 for the potential feeble-minded as compared with 60 for the morons.

We need not consider the "deferred" cases, because the diagnosis in these cases was suspended, frequently because the children were unable to do themselves justice in the B.-S. or literary tests on account of linguistic or speech handicaps. Most of these cases graded appreciably higher in motor tests.

The girl diagnosed as normal, case Twenty-three, an only child, was an epileptic who graded normal at the time of the examination. At the age of eight she measured 7.8 years by the 1911 and 8.4 by the 1908, while grading only 7 years by the Seguin form board according to the combined norms and $6\frac{1}{2}$ according to the writer's norms. The physical examination was negative save for the epilepsy and a recent attack of pneumonia with pleuritic effusion for which she had been operated but from which she had not completely recovered. The epileptic convulsions began at six months and had continued irregularly, averaging perhaps two or three attacks a week. She was somewhat retarded in her early development, cutting her first tooth at nine months without any illness, first standing at twelve, walking at 15 months, and using single words at twelve and short phrases at fifteen months. She had been in school two and a half years, but her attendance had been very irregular. She did best in arithmetic and poorest in reading. She was assigned to a special school on the assumption that she would stagnate mentally.

After two years and three months in the special school the record shows that the seizures (a mild form of grand mal) have continued, sometimes as frequently as three or four times a day, in consequence of which she has been out an average of two days a week. The first two reports recorded improvement in reading, while the last report (June, 1918) indicated that she had lost ground in reading and spelling, while she had improved in arithmetic, advancing from I³ at the time of entrance to II³ (at the age of 10 years). She did fairly well in basketry, plain hand sewing and simple and ornamental stitching, and enjoys this work. Her greatest capacities were reported in handwork and arithmetic, she is willing but tires easily and is always seeking a change of occupation. She is inclined to be willful and selfish, and her greatest fault is "unkindness to playmates." In Gray's oral reading test she scored only 2.5, which is decidedly below the 1⁴ standard. She spelled all the words in Ayres A to D, doing second grade or better, and 82% of the words in E, which is not equal to second grade. She had a seizure when column I was given. In the spiral arithmetic exercises she did 7 samples in test A, 3 in B, 1 in C, 2 in D, 1 in E and 1 in G. How much these scores are below III² standard the inadequate norms make it impossible to determine.

It is of interest to note that the B.-S. VIII-, IX- and XI-year olds do about as well as the special school children classified in the second grade, the X-year old doing somewhat better. There are no other correspondences which are even approximate. All the other B.-S. age groups do decidedly poorer than the second grade pupils. Our imbeciles and potential morons are inferior to our first grade group, while the scores in all the other categories in Table XVI are decidedly lower than the score for our second grade group.

SEX DIFFERENCES

The girls surpass the boys in the majority of the classifications. In Table XIII, grade classification, they excel in the first three grades and in the general average,

while the boys excel in grade IV. The girls did 40% better than the boys in grade I, 14% better in grade II, only very slightly better in grade III, while the average score for all the girls was 29% higher than the boys' general average. Although the girls averaged about a third of a year older in chronological age, they averaged about a third of a year lower than the boys in intelligence age. In the tabulation according to B.-S. age, Table XIV, the girls' scores were higher in five ages and the boys' in one, the differences in most ages being small. In the general averages for all the B.-S. ages, the girls did 23% better than the boys. The intelligence age was higher in four ages for the boys than for the girls and in two ages for the girls, but the differences are too small to be of consequence. The boys had been in school longer than the girls in five ages, while the girls had been in school longer than the boys in two ages, but here, again, the differences are negligible. The boys were older than the girls in 5 ages and the girls older than the boys in only one age. Therefore, while the advantages were on the side of the boys, the girls excelled in reading. In the diagnosis classification, Table XVI, the girls excelled among the imbeciles, morons, potential feeble-minded and borderline, and the boys among the potential morons, backward and deferred. Among the pupils in the regular grades in St. Louis the girls excelled in every grade except the first, the difference amounting approximately to the "progress made in from one-fourth to one-third of a year."*

VARIABILITY

Our discussion of variability will be restricted to a consideration of the quartile deviation (Q) and range (R) for each age in the B.-S. classification and the distribution of the scores in age VII, which contains the largest number of pupils.

As shown in Table XVII there were some pupils in every B.-S. age (except X and XI in each of which there was only one pupil), who did not score a single point. The number of pupils failing completely has already been given for ages III, IV, VI and VII. In age V 2 out of 26 made zero scores; in age VIII, 5 out of 48; and in IX, 2 out of 10. While the modal number of the VII year olds, 47%, Table XVIII, registered complete failures, 11% scored from 45 to 60. It is noticeable that above the zero score there is no considerable concentration of scores in any of the 21 groupings among the VII-year olds.

TABLE XVII

THE Q AND R FOR THE ORAL READING TEST ACCORDING TO B.-S. AGE

B.-S. Ages	III		IV		V		VI		VII		VIII		IX	
	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R
Boys	0	0	0	0	.47	0-17.5	7.5	0-58.75	11.87	0-60	14.37	0-52.5	16.56	0-57.5
Girls ....	..	.....	0	0-16.25	0	0	10.4	0-56.25	19.68	0-52.5	13.75	0-63.75	25.62	51.25
Both	0	0	0	0-16.25	0	0-17.5	7.9	0-58.75	17.02	0-60	12.5	0-63.75	17.81	0-57.5

TABLE XVIII

DISTRIBUTION OF READING SCORES IN B.-S. AGE VII

	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50	52.5	55	57.5	60
Boys.	29	4	3	1	1	..	..	..	2	1	1	1	..	2	1	1	1	1	1	1	1	1	1	1	1
Girls.	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Both	33	6	4	2	2	2	2	2	3	2	2	2	3	3	2	2	2	2	2	2	2	2	2	2	2

*Gray, as before, p. 139.

The range (R) from the zero scores varied in the different ages from 16.25 in age IV to 63.75 in age VIII. The variation in the low B.-S. ages is small, of course, because even the best readers did poorly. The Q varies from 0, in ages III, IV, and V, which contain a preponderance of zero scores, to 17.02 in age VII, which is about the same as the average score in this age. The Q's expressed as a percentage of the average scores in the corresponding B.-S. ages are 69% in age VI, 102% in age VII, 41% in age VIII, and 58% in age IX. It is evident that the variability in reading capacity among our mental defectives is enormous, even when they are classified homogeneously as to intelligence. Apparently no definite conclusions could be drawn from reading capacity regarding the intelligence level of mental defectives, nor could any inference be drawn regarding individuals' reading capacity from the intelligence level. If we divide Gray's "P. E." figures* by 2 (or multiply our Q's by 2) our variability based upon the B.-S. classification can be compared with the variability of the pupils in the regular schools when classified according to grade. Among the first grade pupils in the St. Louis schools the variability is greater than among our VI-year olds and almost as great as among our VIII-year olds, but considerably less than among our VII- and IX-year olds. But the variability in the regular grades above the first is only from one-half to one-fifth as large as the variability in our ages from VI to IX.

The reading ability of many was so poor in relation to their intelligence as almost to constitute a specific reading disability. It would be impracticable to attempt to analyze all of these poor reading records. Our case analysis will perforce have to be restricted to the pupils with the highest intelligence level (IX) who completely failed in the reading test.

Case Twenty-four was a former epileptic who was referred to the clinic at the age of 12.5 years, after having been in five different schools in as many years (including a rural school and a special class). He had been advanced to II⁴ in school. The principal referred him because of "inability to command language sufficient to advance." His greatest deficiencies were reported in "language, reading, spelling and composition," and his greatest capacity in arithmetic. "He is strong, healthy, quiet, orderly and well disposed toward others, but very feeble in grasping ideas. In reading he seems to tell his own story instead of pronouncing the words of the book. He sits quietly in the seat and tries to do his work. One brother is a painter who works regularly and earns \$1.25 per day, age 15 (in April, 1917). One brother, age 10, is in our third grade and gets on." According to his earlier record in the special school he did less than second grade work and was poorest in reading. The developmental history indicated that he was born on time, weighing 12 pounds, that he began to have spasms at 6 months, and that they continued intermittently, coming on with a high fever, until the age of seven years. He foamed at the mouth and lost consciousness during the seizures. At 10 months he had a "double dose of malaria fever," and subsequently whooping cough, chicken pox and measles. He cut his first tooth at 9 months, sat at 6, stood at 12, took his first steps at 18 and used single words at two years. He was the second of three boys, an unwelcome child, born when the mother was 23 and the father 27. "The father formerly had some disease about which the mother is reticent." The mother said that her husband could not read a word and did not know a single letter at the time of his marriage, but he now reads and writes a little. He was born in St. Louis, probably received some schooling, she thinks, and is now a laborer in "comfortable financial conditions." The boy's physical examination was negative save for a "drowsy" expression, outstanding ears, high palatal arch, and stoop shoulders. By the 1908 scale he was retarded 2.5 years from

*As before, p. 130.

the upper base and 3.3 years from the lower base, and by the 1911 scale three and a half years (I. Q. .72). By the Seguin form board he was retarded only half a year by the combined norms and one year by the writer's norms. His reading of the Binet selection* was very halting and imperfect. With much aid he required a minute and a half to read to "dollars" (30 words). His reproduction was: "three homes there in winter and summer, 1000 dresses;" which is quite at variance with the text. His auditory memory span was limited, as determined by the digit test. He failed to reproduce 6 digits. His percentiles in standing and sitting height, weight, and right and left grip were 100, 100, 95, 85 and 70. In other words, he was above average in physical development. A diagnosis of borderline intelligence, with dyslexia as a possible complication, was made, both conditions probably being due to general and focal cerebral trauma from the epileptic attacks, and he was reassigned to a special school.

According to the report from the special school in June, 1917, he was reported as doing about II⁴ throughout. He left school in April of the following year, hence we have no report for 1918. In the Starch spelling test his rating was about grade one and a half in column I and almost grade III in column II. In Ayres I he did somewhat better than third grade, in L about fifth grade, and in O one-half of the third grade score. This record is rather remarkable in view of the fact that he scored zero in reading.

Case Twenty-five was first referred for examination in February, 1916, when 9.9 years old. He had been in school over 3 years and had been advanced to the second grade second quarter. He was reported weakest in reading, spelling and number work, and best in writing, although showing the greatest interest in drawing. The developmental history was not very favorable. He was born on time but cyanotic after a difficult labor of 10 hours, weight 12 pounds; had measles at 2, and whooping cough and chicken pox at 3; he was run over at one time by an ice wagon, and received an injury to the head which did not produce loss of consciousness, while he fell off a street car later at the age of seven, remaining unconscious for several hours. The mother, however, said she never noticed that he was slow, nor did she notice any mental changes after the accidents. She had regarded him as quick and bright, but he had been hot tempered, mischievous and subject to night terrors. He was reported to have cut his first tooth and to have sat up at 6 months, he stood at 10, took first steps at 13, walked at 14, and used single words at 18 months. He was the third of 3 brothers, the two others being brighter, according to the mother. At the time of birth the father was 43 and the mother 35. Her health was poor during and after conception. The physical examination of the boy revealed a dull countenance, slightly enlarged tonsils, two carious teeth, slightly outstanding ears, tinnitus, mildly impaired hearing, a low hair line and turned-in toes. By the 1908 and 1911 scales he was retarded 2.1 years (I. Q. .78). By the Seguin form board he was retarded almost a year and a half by the combined norms and almost two and a half by the writer's norms. He failed on the Healy-Fernald form board A after 1 minute 30 seconds, placing only 3 blocks properly in 22 moves. He failed on the X-year designs (visual imagination) and repeated four digits backward but failed on five backward (auditory memory). He was able to read a few short monosyllables but could not read "on," "bed" or "in." His percentiles in standing and sitting height, weight, and right and left grip were 60, 80, 75, 83, and 87, thus being above average in physical development. He was diagnosed as not above "very backward" or borderline in general intelligence, with visual aphasia as a suspected complication, the conditions probably being due to the mother's poor health during gestation, to the boy's cyanotic condition incident to the

*See Experimental Studies of Mental Defectives, 1912, p. 130.

prolonged and difficult labor which may have produced ruptures of some of the cerebral capillaries or injuries to some of the brain cells, and to cerebral trauma from the two accidents. He was recommended for a try-out in an ungraded class. But he failed to receive the advantages of individual instruction in such a class because none was available in his district, and he was referred again to the clinic in October, 1917. But the parents would not consent to the examination until January, 1918, when he was 11.83 years old. Another principal this time reported that "he is unable to learn out of books. His interest is in manual work but not in books. His best work is along mechanical lines, while his greatest interest is in games. His greatest deficiencies are in spelling, reading, memory and attention. He has acquired truant habits. His brother, 14 years old, is in the fifth grade, is slow but has good habits." He had now been advanced to III². He had had his adenoids and tonsils removed about a year prior to the second examination. When re-examined his thyroid was slightly enlarged, he had a slight tic about the mouth, and still needed dental attention. By the Stanford scale he was now retarded 2.8 years (I. Q. .76). In somewhat less than two years he had advanced 1.2 year in intelligence—the advance was probably greater, as the Stanford scale grades lower than the old scales—while he graded just the same by the Seguin form board, the retardation now amounting to 4.5 years by the combined norms and about five years by the writer's norms. Based on his school record in manual work, however, the Seguin rating does not do him justice. His reading was still extremely poor. He required 60 seconds to read to "fire" in the Stanford selection (five words), but he received assistance on "New York" and "September" and misread "5th." In the vocabulary test he did much better, scoring 6,484, which is superior to the X-year norm. The diagnosis of visual aphasia was definitely confirmed, while he was diagnosed as borderline from the standpoint of general intelligence. He was transferred to a special school in view of the unavailability of an ungraded class. The report from the special school at the end of the year indicated that his record was "good" in physical games, "fair" in formal motor training, calisthenics, wood work, raffia, gardening, oral language (grade II¹) and geography (III¹), and poor in drawing, writing (grade II), reading (I⁴), written language (I⁴), spelling (I⁴) and arithmetic (II¹). His best work was along monumental lines, and poorest work in reading, spelling and written language. He did not get the spelling tests, but in the arithmetic tests he scored 8 in A, 6 in B, 2 in C, 5 in D, 1 in E and 3 in G. These are all less than III² except G, but how much less cannot be determined. The tests, however, tend to confirm the report of the teacher that he did better in arithmetic than reading.

Both of the above poor readers happened to be visual aphasia cases, while two other conspicuously poor readers whom we have already discussed in the section on spelling (numbers Ten and Eleven) were also cases of partial visual aphasia, or dyslexia. It should not be inferred from this that all cases of conspicuously poor reading should be ascribed to visual aphasia. We have examined many poor readers among children whose parents were immigrants or who habitually spoke a foreign language in the home. The poor reading in many cases was undoubtedly due to the pupils' linguistic handicap. In a number of instances the poor reading ability has been traced to optical defects, or defects in hearing, or defective distribution of attention. In innumerable cases it has been due to very grave deficiency in general intelligence (idiocy and imbecility) and therefore not to visual aphasia. Nevertheless, it is probable that the instances in which poor reading ability is directly traceable to visual aphasia or dyslexia are more numerous than is usually suspected. Between September, 1914, and June, 1919, we identified in the St. Louis schools about 90 cases of visual

aphasia and dyslexia,* varying in intelligence from normal to borderline and high-grade feeble-minded. Prior to this we had identified a number of cases whose records are not now at our command. Doubtless many cases in the St. Louis schools have not been referred to us at all, as our examinations have perforce been limited to the children of the lowest degree of general intelligence. Whether due to a specific lesion of the left angular (and supra-marginal) gyrus or to a biological variation, resulting in the impairment of visual word images, we have not found that there is any essential difference in the different grades of the defect. The different degrees of word-blindness (as the condition is also known) are probably quantitative variations of the same neuro-psychic trait. Nor have we been able to accept Hinshelwood's criterion, that the symptoms must be pure, that is, the condition must not be accompanied by any other brain defect. Hinshelwood restricts the application of the term "congenital word blindness" to very serious degrees of visual aphasia in which all the cerebral areas other than the angular gyrus are normal and undamaged, "dyslexia" is applied to the slighter degrees of the defect, while "congenital alexia" is restricted to the inability to learn to read in mental defectives who are suffering from a generalized cerebral defect. We fail to see, however, why a defect in the left angular gyrus may not coexist with various degrees of defect in other cerebral areas, without producing any essential alteration in the nature of the word blindness. Even if cerebral areas closely related to reading were affected it would only add complications to the primal regional defect. It would accentuate the degree of the defect rather than producing essential qualitative changes. There was empirically no warrant for restricting the application of "congenital word blindness" in accordance with Hinshelwood's recommendation, for none of the cases cited by him or his predecessors were psychologically tested to determine whether they were strictly normal. We have psychologically examined all of our cases in the course of our ordinary routine, and hope to publish the data some time in the future.† Here we must be content with the general statement that few of our word-blind cases were strictly normal in intelligence while few were affected so gravely that they could not learn to read at all. The large majority were cases of dyslexia rather than of visual aphasia. We find it convenient to restrict the application of the term "visual aphasia" (or alexia) to the graver degrees of word-blindness, and the term "dyslexia" to the lighter degrees, while using "word-blindness" as the generic term. But we do not consider that there is any essential qualitative difference between visual aphasia and dyslexia. They are merely gradations of the same phenomenon.

It would be advisable to bring children with specific reading defect together in special classes, in order that the pedagogical treatment of the disability could be intensively studied under the best experimental conditions. We have tried two or three methods during the last seven years, in some cases with considerable success, in other cases with very meagre results considering the large expenditure of time and energy made by the teachers.

The methods we have used are, briefly, as follows: 1. A synthetic procedure, leading from the alphabetic to the word method, and finally to the sentence method. The first step is to develop visual memories of the separate letters of the alphabet, both small and capital, so the child can recognize them by sight. We have ordinarily begun with the script symbols. The teacher presents the visual symbol of the letter and names it. The child repeats the name aloud. He should also be required to write it.

*Hinshelwood met with 31 cases in 15 years. We assume that these cases came to him merely as an incident to his regular eye practice. Many of his cases were acquired. All of ours are congenital.

†A study has already appeared. *Congenital Word Blindness—Some Analyses of Cases*. The Training School Bulletin, 1920, 76-84, 93-99.

In this procedure an appeal was made to visual, auditory, glosso-motor and grapho-motor sensations. The auditory and motor associations, if the mechanism is intact, should aid in the fixation of the visual letter images. Without the letter images the child cannot learn to recognize the letters. Where there is word blindness, but not letter blindness, the development of letter recognition does not present any serious obstacles. But where there is letter blindness of considerable severity it is very difficult to develop visual images even of the small number of impressions corresponding to the small and capital letters in print and script. The number of letters is very small indeed compared with the hundreds of thousands of word symbols. The next step is to have the child spell the words aloud letter by letter. If the mechanism is intact the auditory and glosso-motor imagery will aid in the visual recognition of the word. Spelling the word aloud over and over again will help to fix the association between the visual impression and its sound and meaning. While many of these children are poor in oral as well as in written spelling, many can spell words orally (and sometimes graphically) which they cannot recognize visually. It is important to begin with phonetic and short words. In the third place, have the pupil also write the words, sometimes naming the letters aloud as he writes and sometimes pronouncing the words after they have been written. In the fourth place, drill the pupil in the recognition of the whole word by sight—word calling. When the pupil has acquired a sufficient number of word memories he should be able to read sentences at sight. He should then, finally, be given much practice in sentence reading. Hinshelwood supplements a somewhat similar procedure by the use of the tactual exploration of letters cut out of wood. We have had pupils trace raised and depressed letters with the finger; we have also had pupils who were incapable of making fine co-ordinations trace letters on the ground with a large stick or in the air with the whole arm movement, but we are not ready to pass judgment on the value of these devices. It is necessary to repeat the above exercises again and again, sometimes for a long period of time. It is better to give the drills in several short periods a day than in one long period. Reading drills cause much fatigue and confusion in the case of most word blind pupils.

The following is a very much simpler procedure: The teacher shows monosyllabic words separately in printed and written form and pronounces them. The child pronounces the syllable and writes it. This process is repeated again and again until the child gets a foundation of visual word images. Thereafter use may be made of the ordinary word and sentence methods. This has proved fairly effective with some poor readers. Grace M. Fernald has found it successful with some apparently hopeless cases—e. g., a girl who was unable to read and who had been diagnosed as moron was taught to read by this method and promoted into high school where she did good work.*

Clara Schmitt has studied the use of several well-known methods in combination; action by the pupil in response to commands presented through sight words and sentences, phonic drills presented in stories, analysis of sound forms in words, using sentences, and the writing of phonetic words on the board.

The most recent studies of congenital visual aphasia and dyslexia may be found in: James Hinshelwood, *Congenital Word-Blindness*, 1917; Augusta F. Bronner, *Psychology of Special Abilities and Disabilities*, 1917; Clara Schmitt, *Development Alexia: Congenital Word-Blindness, or Inability to Read*, the *Elementary School Journal*, 1918, 68f. and 757f. C. H. Heitmüller, *Cases of Developmental Alexia or Congenital Word-*

*The following study should be consulted, which has appeared since the above was written Fernald, Grace M., and Keller, Helen. *The Effect of Kinaesthetic Factors in the Development of Word Recognition in the Case of Non-Readers*. *Journal of Educational Research*, 1921, pp. 395-377—a record of very suggestive experiments.

Blindness, Washington Medical Annals, XVIII, No. 2; J. E. Wallace Wallin, Congenital Word-Blindness—Some Analyses of Cases, The Training School Bulletin, 1920, pp. 76-84, and 93-99.

It is somewhat difficult to select instances of good readers from the Gray records because there is practically no difference in the raw scores in the scale from III⁴ to VIII⁴.* The score in III⁴ is 50 as against 49 in IV², 52 in IV⁴, between 49 and 51 in grades V to VIII, and 51 in VIII⁴. The fact that the raw scores are practically the same from the third to the eighth grade is not due, however, to the fact that the successive paragraphs do not gradually increase in difficulty, or to the fact that the pupils do not improve as we go up the grades, but to the diminishing amount of credit arbitrarily allocated to the first paragraph in each successive grade. Thus the value assigned to paragraph one for a pupil in grade I is 55, in grade II 35, in grade III 30, in grade IV 25, in grade V 20, in grade VI 15, in grade VII 10, and in grade VIII 5, while the value for the other paragraphs remains the same in all grades, namely, 5 (except paragraph 11, where the value is 10). It is evident, therefore, that the lower the grade classification given the child the higher will be the score which he will receive. In order to compensate for this tendency of the scores to attenuate as we go up the grades Gray has given a diagram in which "all scores which lie on the same horizontal level represent equal amounts of achievement." The scores can, of course, be rendered comparable by subtracting from the scores in a given grade the added credit which was given for paragraph one in all the lower grades.

A practical obstacle in connection with this differential scheme of rating is the initial difficulty of determining just the grade in which the child shall be classified. Shall we classify a child as second grade merely because he happens to be in the second grade or merely because, say, he has been in school two years? Is it immaterial whether he has been in school two years, or four or five years? The fact that the child is in the second grade may not at all indicate that he is doing second grade work in reading. He may be especially weak or especially strong in reading, so that if the classification is to be based on the estimate of actual achievement in reading, we should have the practical difficulty of determining whether to rate him as, say, first, second or third grade. This practical difficulty constantly confronts one in giving the tests to special school children, who may not be classified in any grade, who may be doing a different grade of work in every branch and who may have been in school during widely varying periods of time. If the mistake were made of grading a third grade pupil as second grade the error would not be very large, amounting to only five points. But if a second grade pupil were rated as a first grade pupil the error would amount to 20 points, and wholly misleading and ridiculous results could easily be obtained, as we shall show in connection with one of our cases.

Another serious difficulty caused by this arbitrary method of rating is that it is almost impossible to compare the achievement of our special school children in different B.-S. ages and in different intelligence classifications with the achievement of the normal children in the different grades, owing to the fact that the children in a given B.-S. age or in a given intelligence classification are classified in different grades in reading. Children in the same classification may therefore be rated on a different basis in reading.

For these reasons it seems preferable to give uniform credit for the same unit of work, as has been done in the spiral arithmetic exercises, in the spelling tests and in many other educational tests. Comparable results can only be secured if the unit of measurement is kept uniform. Indeed we can only compare the scores in the Gray

*Gray, as before, p. 126

scale after the initial advantages in rating have been deducted, so that the basis is uniform for all grades. We have, however, followed Gray's method of scoring, in spite of the special difficulties involved. If anyone wishes to score our results differently we shall be glad to make the records available.

We shall only examine the records of the two pupils who made the highest scores in the reading test.

One of these, case Twenty-six, was a Mongolian type of mental defective, who was diagnosed at the time of the examination as a high grade imbecile and who will furnish a good illustration of the truth of the statement which we have already made, that Mongolian defectives frequently have specific ability in reading, as judged by their level of general intelligence and by their ability along other lines. This girl was examined in December, 1914, when 9.5 years old. At that time she had been 3 years in school, over a year of this time being spent in special school. Her greatest capacities were said to be in reading and number, her greatest interests in music and her greatest defects in physical and manumental work. She proved to be 3.3 years backward by the 1908 scale and 3.5 by the 1911 scale (I. Q. .63). By the Seguin form board she did somewhat better than a three year old child according to the combined norms.

She was extremely crude in this type of motor performance. The first time she required 18 moves and 67 seconds to complete the task; the second time 40 moves and 135 seconds; and the third time, 34 moves and 136 seconds. She was unable to read even monosyllables in print, although she was able to read script in school. Her percentiles in standing and sitting height, weight, and right and left grip were 10, 30, 20, 0 and 5, and her head girth was that of a two or three year old child (18.6 inches). It is apparent that she was decidedly under-developed physically. She was given the Seguin form board test and certain anthropometric measurements on two later occasions. In the form board her performance advanced from about 3 years (67 seconds) to almost 4 years (42 seconds) in July, 1915, and to about 5½ years (29 seconds) in July, 1916. During the latter examination, at 11 years, her percentiles, in the order given above, were 20, 55, 20, 5 and 10. She had raised her position somewhat in standing and sitting height and in strength of grip. Her head girth was now 19 inches, antero-posterior diameter 157 mm., transverse diameter 137 and cephalic index 87.3. The physical examination revealed short fingers and thumbs, a narrow palate, with a rather low and flat dome; obliquely set eye-balls (mongoloid); a low broad forehead with a poorly defined hair line; a slender, sluggish tongue, and fissured mucosa; several carious teeth; a narrow superior dental arch, poor alignment of teeth, the lower central incisors articulating too far forward; small round outstanding ears; a small, broad nose, with small round nostrils, and a septum deflected to the right; anterior and post-nasal obstruction, with a chronic discharge; suspected myopia; and deficient neuro-muscular tonus. She walked with the feet wide apart. She had some of the typical physical stigmata of Mongolism.

She was the first born of two sisters, the mother being 35 and the father 45 at the time of her birth. Both parents are dead. The mother was said to have been "nervous" and "insane", and the father mentally queer and alcoholic. The girl was born on time without difficulty or injury. She has only had whooping cough, measles and croup, all being followed by complete recovery. She cut her first tooth at 16 months, sat at 9 months, but could not support the head, first stood at 18, took first steps and walked at 30, used single words at 11 and short phrases at 12 months. Her sister was said to be mentally normal. Generally only one Mongolian defective is born to a family.

We have received four annual reports of the progress of this pupil in the special school. These reports have indicated that she does not like any kind of handwork

and is very clumsy in motor activities, which is quite characteristic of Mongolians. In spool knitting she makes mistakes constantly and cannot correct them. She is slow to respond in games and physical training and follows directions poorly, although she has made considerable improvement in these activities. Although still very poor she has made considerable progress in writing. The report, in June, 1917, when she was twelve years, indicated, however, that she was doing III² work in reading, and III¹ in oral and written spelling, she was "very good" in oral language, and dramatization, while she only did I² work in arithmetic, being unable to solve problems or do any mental arithmetic. Her greatest capacities were reported to be reading and spelling, and her greatest improvement during the year was in writing and participation in games. Her greatest faults were that "she is self-centered, greedy and eats like an animal." But in common with most Mongolian defectives, she is "cheerful and happy."

The June, 1918, school record would lead us to infer that she had retrograded in reading and spelling, as she was only rated as II⁴ in the former and I⁴ in the latter, while advancing to I³ in arithmetic.

When we turn to the standardized tests we find that her score in the Gray oral reading test was 56.25 which is 4.25 points higher than the raw score in any grade in the St. Louis elementary schools, and 6.25 higher than grade III⁴. We find, however, that this score was based upon second grade classification, so that children in the third and fourth grades to do equally well would have to earn only 51.25 and 46.25 points, respectively. The III⁴ norms for the normal pupils is 1.25 less and for the IV² 2.75 higher. If our subject were classified in the third grade, as she was reported in June, 1917, and given a score of 51.25, she would still grade somewhat better than III⁴. In the Ayres spelling test she did a little better than the second grade in I, but only spelled 5 words in L and one word in O. In the Starch test she reached the first grade standard in I and a little better than first grade in II. She was not given the spiral arithmetic exercises because it was a "foregone conclusion that she could not do any of them." It is perfectly evident from the school reports and standardized tests that this girl had special aptitude in reading, especially as compared with spelling and arithmetic.

Case Twenty-seven was examined in September, 1917, at the age of 11 years. She had been over 5 years in school and had been advanced to III³, without any probability of being promoted. She was reported best in reading and handwork and poorest in arithmetic and spelling. In school she was "subject to nervous chills terminating in crying spells." She was born on time after a protracted labor of two days. Three years before the examination she became subject to grand mal attacks, which stopped for a year, and then returned. She had had none for over half a year before the examination. She was slow in her early development, cutting her first tooth at 10 months, first standing at 14 months, taking her first steps when about two years, walking a little later, not using single words until she was two and not using phrases until after two. She was the fifth of seven children, two of the others being dead. The physical examination showed that she was a mouth breather, that she had enlarged tonsils, possibly adenoids and one carious tooth, and that her nervous tone was poor. Her speech was very indistinct, owing to a severe lisp. By the Stanford scale she was retarded 3 years (I. Q. 79) while she was extremely slow to respond in the Seguin form board, measuring about five years retarded. An unfavorable prognosis was made, owing to probable cerebral trauma from the epileptic convulsions, and she was assigned to a special school as a "potential mental defective."

The report from the special school at the end of the year (June, 1918), indicated that she had little power in physical and mental games, calisthenics, knitting, sewing,

drawing and writing. She did about second grade work in reading and arithmetic, first grade work in spelling and was "good" in reproducing memory gems and stories. Her greatest improvement and capacities were in "academic work," she makes good effort at times and she is "hysterical" in disposition.

In the oral reading test she scored 63.75, which is decidedly higher than any score obtained among normal children. Since the score was based upon the first grade base, children in the second and third grade to do equally well would only have to earn 43.75 and 38.75. It is evident that her excessively high score is due to the fact that she was classified in the first grade instead of the second grade, as she had been independently reported to the clinic. If we assume that the second grade classification is more nearly correct, her score falls about midway between II^2 and II^4 . It is evident that, although she had been given the highest "raw" score among all our special school pupils, she is inferior to many who received a lower raw score. Nevertheless we consider that she possesses more ability in reading and arithmetic than in any other line of work. In the Ayres test she spelled only 1, 2, and 6 words in columns O, L, and I, while she did somewhat better in the Starch lists, doing a trifle better than first grade work. In the spiral arithmetic exercises she did 7 examples in A, 2 in B, 3 in C, 3 in E, 2 in J and one in M. These results are all decidedly below the lowest norms supplied (third grade) except in E, J and M, which are about equal to third grade.

COMPARISON OF THE EFFICIENCY SCORES OF MENTALLY DEFECTIVE WITH NORMAL PUPILS

The normal norms are based upon the scores obtained in the survey of the St. Louis schools. This survey was made in June, a few weeks later in the school year than our survey of the special schools was made.

The scores made by our special school pupils were uniformly lower than those made by the normal pupils in the corresponding grades, the efficiency of the special schools in grade I amounting to 16% of the normal grade I^4 score; in grade II, 84% of the normal II^2 scores; in grade III, 87% of the normal grade III^2 score; and in grade IV, 95% of the normal grade IV^2 score. The score in our third grade was less than the normal II^4 score (which, however, is somewhat higher than III^2 in the St. Louis scale of norms), while the score in our fourth grade is approximately the same as the norms for III^2 (or II^4). It must not be forgotten that comparisons between different grades is complicated by the unequal value given the first paragraph in the different grades.

In the B.-S. classification, Table XIV, the average scores in all the ages fell below the normal I^4 or II^2 standard (the raw II^2 standard is only one point higher than I^4). Only the scores in ages VIII to XI even approximated the I^4 or II^2 norms. These comparisons, however, are of limited value, because exact comparison between the normal grade scores and the B.-S. age scores cannot be made owing to the use of a different basis of scoring for pupils in different grades. The same remark applies to comparison with our diagnosis scores.

In the diagnosis classification only the borderline and backward even remotely approximate the raw norms for grades I^4 or II^2 . The score for the highest group of mental defectives, the morons, is only 47% as large as the raw score for the normal I^4 grade, or 49% of the normal II^2 score. The I^4 score, however, is practically equal to the beginning of the second grade, and the II^2 score to the beginning of II^2 , since the test in the regular grades was given at the end of the school year.

If, now, we deduct 20 points, which equals the artificial advantage given the normal first grade pupils, and allow for the difference in the school year when the tests were

given, we may say that our backward and borderline did about as well as the pupils at the end of the second grade or beginning of the third, while the morons did about as well as the pupils at the beginning of the second grade third quarter.

TABLE XIX
AVERAGE RATE OF READING AND AVERAGE NUMBER OF ERRORS

Grade	No. of Pupils	No. of Seconds	No. of Errors
Paragraph 1			
I	160*	130.44	12.38
II	87	34.32	2.26
III	45	25	1.48
IV	4	24.	.75
Paragraph 4			
I	39	106.82	8.84
II	84	55.5	4.83
III	45	38.95	2.42
IV	4	40.	2.
Paragraph 8			
I	18	83.5	11.5
II	23	74.56	9.39
III	4	45.25	6.75

There were a few morons and borderline whose raw scores were equal to or superior to the third grade score. There were four such cases among the 66 morons, or 6% of the morons. The scores of one of these pupils was based on third grade classification, two on second grade and one on first grade. If we assign to the latter pupil a second grade rating he will be reduced to second grade status in the test (reduced from 60 to 40). If the pupils rated as second grade were given a third grade rating, only one, with 48.75 points, would reach the third grade score. It is evident that only a negligible number of our morons reached the third grade level in the test.

Ten of the 45 borderline pupils (22%) reached or exceeded the third grade score. Two of these, however, had been classified in the first grade, although the regular annual report to the clinic indicated that they did second grade work. If classified as of second grade for the purpose of this evaluation their scores would fall below the first grade standard. Three of the other pupils were classified in the second grade, four in the third grade and one in the fourth. As we should expect, a larger percentage of borderline children than morons reached the third grade standard.

In order to appreciate the significance of the figures on time and errors given in Table XIX, we have computed the following indices showing the increased amount of time required by the mental defectives to read paragraphs I, IV and VIII, and the increased number of errors which they made in reading these paragraphs, as compared with the pupils in the regular grades in the St. Louis schools. We have confined the comparison to the paragraphs for which norms are available. The indices are obtained by dividing the figures obtained from the pupils in the regular grades† into the figures for the mental defectives classified in the corresponding grade.

*The discrepancy in the number of subjects given under this paragraph and the number given in Table XIII is due to the fact that the time was not recorded for some of the pupils who failed completely.

†See Gray, as before, p. 133.

	Paragraph I		Paragraph IV		Paragraph VIII	
	Time	Error	Time	Error	Time	Error
Grade I.....	3.00	6.83	1.78	3.17	.....	.....
Grade II.....	1.47	2.93	1.67	2.72	2.05	2.75
Grade III.....	1.30	2.59	1.46	1.53	2.31	2.71
Grade IV.....	1.53	2.02	1.83	1.72	1.52	2.25

The figures show that it took the mentally deficient pupils from one and a third to three times as long to read a paragraph as the pupils in the regular schools who were classified in the same grade, although the mental deficients averaged three or four years older in chronological age in each grade, as shown in Table XIII. In regard to the number of errors made in the reading, the comparison is even more unfavorable to the subnormals. They made from one and a half to almost seven times as many errors as the regular grade pupils, making relatively more errors in the lower grades. It is to be remembered that this does not include errors in the nature of speech defects which are more numerous among the mental defectives. In our investigation of speech defectives in the St. Louis schools in 1915, we found ten times as many speech defectives in the special schools as in the white elementary schools.*

GENERAL CONCLUSIONS

- 1 The process of reading is entirely too difficult for mental defectives and subnormals of kindergarten grade and III- and IV-year mentalities. All the kindergarten pupils and III-year olds (B.-S.) and 10 of the 11 IV-year olds failed completely in the oral reading test. Moreover, the large majority of the imbeciles, V-year olds and pupils classified in the first grade also failed completely in the oral reading test. Of the 164 first grade pupils, 123 scored zero; of the 36 imbeciles, 27 scored zero; and of the 26 V-year olds, 21 scored zero. The scores of 3 of the V-year olds who succeeded in the test were merely nominal, 1.25, 1.25, and 2.5. All three had been diagnosed as imbeciles. The other two scored 13.75 and 17.5 and had been diagnosed, respectively, as moron and as deferred. Four among the imbeciles who scored made only from 1.25 to 2.5 points. At the time of the examination their mentalities were V, V, 5.3 and 6.6. The scores of the other five imbeciles were 12.5, 13.75, 16.25, 43.75 and 56.25, while their mental ages at the time of the examination were VI, VII, 4.2, 6.2 (Stanford) and VI. The largest of these scores was made by a Mongolian while the pupil with the four-year mentality was also a Mongolian.

Certainly the teaching of reading to imbeciles and mental defectives who have not reached a mentality of about six years does not result in the acquisition of any useful form of skill. We could cite numerous instances of imbeciles barely reaching a V-year mentality who after six or seven years of instruction in reading do not read as well as a normal first grade child. If we exclude the higher grade of the two Mongolians (case Twenty-six) only one imbecile even approximately reached first grade status in the test. This pupil graded 6.2 by the Stanford scale. At the time she was 11.08 years old, thus being retarded 4.8 years (I. Q. 56). She made a score of 43.75,

*Report of the Psycho-Educational Clinic and Special Schools, in the Annual Report of the Board of Education of the City of St. Louis for the year 1915-1916, pp. 174-211.

A Census of Speech Defectives Among 89,057 Public School Pupils—A Preliminary Report, School and Society, 1916, 213f.

computed from the second grade base, which is superior to normal II³. The record from the special and elementary schools does not indicate that she was especially strong in reading, although she was said to be poorest in arithmetic. According to the special school report she did second grade work. The writer has never hitherto diagnosed a child as an imbecile who could do second grade work, nor does he believe that a child who could do second grade work could be properly so diagnosed. Had this child been examined by the old B.-S. scales she would probably have graded between seven and eight mentally and would thus, according to the usual standards, have approximated the status of a "moron." From what we know of this girl now we believe that she is more properly classified as a moron than an imbecile.*

Excluding this girl, therefore, and the two Mongolians, the highest score made by anyone whom we had diagnosed as an imbecile was 13.75, by a seven year mentality, which is only about one-third of the normal I⁴ score.

Binet has made the statement that an imbecile cannot be taught to communicate in writing or to read writing or print. He used the ability to learn to read as a differential point between the imbecile and debile or high grade feeble-minded. The debile can read somewhat and communicate simple thoughts in writing. Seguin said that the imbecile learns to "read more or less," but he did not sharply distinguish between "idiots," "imbeciles," and the higher grades of mental defectives. We are inclined to agree with Binet and feel that it is probably preferable to draw the upper limit of imbecility at a mentality of six rather than seven, as has been done. Certainly with the Stanford scale it would be hazardous to maintain that an individual who does not develop beyond seven mentally is an imbecile. Practically, of course, the exact location of the threshold between the imbecile and the moron is of far less importance than the location of the upper threshold of the moron, or highest grade of the feeble-minded. Let us be quick to add that a child cannot be designated an imbecile purely on the basis of inability to learn to read. There are specific causes, in addition to imbecility, of incapacity in reading.

Although instruction in reading for imbeciles and for children whose intelligence is under six, represents a great financial waste and a waste of much effort on the part of teachers and pupils, yet, owing to the importunity of parents, it would not be politic to attempt to eliminate such instruction entirely. But, after the low grade deficient has been given a fair trial, the time devoted to reading should be considerably reduced, while the instruction should be limited to the rudiments and to familiarizing the child with word-symbols the recognition of which will help him to adjust himself to his environment.

- 2 There is a marked increase in reading ability from grade to grade, even when measured by the raw scores, and from intelligence category to intelligence category, when the comparison is limited to the main categories (the backward excepted), while the increase is less regular from intelligence age (B.-S.) to intelligence age. The greatest gains were made by the second grade compared with the first, by the morons compared with the imbeciles and by the B.-S. VI-

*We have on numerous occasions called attention to the fact that the Stanford revision grades lower than the older versions. We have no hesitancy in affirming that the Stanford scale graded this girl too low. The standards of diagnosis which have been based on the old scales cannot be uncritically applied when the Stanford scale is used. For criticisms of the Stanford scale see our articles on Preliminary Impressions of the Stanford Revision of the Binet-Simon Scale, *The Psychological Clinic*, 1918, 1f.

The Value of the Intelligence Quotient for Individual Diagnosis, *The Journal of Delinquency*, 1919, 109f.

The results of Retests by Means of the Binet Scale, *The Journal of Educational Psychology*, 1921, 391f.

year olds compared with the V-year olds. We have already suggested certain reasons why the large gains occur at these points. The exceptions which are found to the general tendency are due to differences in chronological age, in intelligence age and in length of time in school, to the presence, in some categories, of children with specific reading defect, to the limited number of cases, and to the employment of a differential scheme of weighting the raw scores.

- 3 The improvement from grade to grade was relatively greater for the mentally defective and subnormal pupils than for the normal pupils. Because the most deficient of the subnormals made a very low score, the subnormal group was able to improve more with rising grade, in harmony with our earlier finding, that the backward and mentally defective improve more than the normal from practice, owing to the fact that they make a lower initial score. The normals make a better initial adjustment hence improve less. In offering the above explanation, however, we must not lose sight of the fact that the curves of improvement are dependent upon a scheme of unequal weighting which may affect the two groups differently.
- 4 The scores in the different grades among the special school pupils are lower than the scores in the corresponding grades among the regular grade pupils. The fourth grade specials were about equal to the III² normals. The average score for all of the subnormals who had been examined was not quite equal to one-half of the raw score for the normal I⁴ grade or II³ grade. The scores in the latter grades were only approximated by the pupils with mentalities from VIII to XI, or by those who graded as borderline or backward. The highest grade of the mental defectives, the morons, only did 47% as well as the normal I⁴ pupils or 46% as well as the II³ pupils. Had some of these pupils been given a first grade base instead of a second and third grade base they would have received higher raw scores. If we deduct the 20 points of preferred credit given the pupils in the first grade compared with those in the second grade, we shall probably do ample justice to the morons. Under this process of equalization we find that:
- 5 Our backward and borderline pupils, who average more than 12 years of age, are equal to the normal pupils at the end of the second grade or beginning of the third grade, while our morons, who average over 13 years, are about equal to the pupils in the second grade third quarter. Only an insignificant number of our morons were equal to or superior to third grade pupils, while about 18% of the borderline reached or exceeded the third grade standard.

The conclusions which we thus reach, based on the Gray oral reading test, regarding the reading ability of the highest grade of mental defectives, is in harmony with the conclusions earlier reached from the analysis of the reading ratings given such pupils by the teachers in the St. Louis special schools. 86.4% of the pupils reported upon by the teachers did from sub-kindergarten to second-grade work, 9.7% third grade work and 3.7% fourth grade work. Analysis of the clinical records indicated that some of the pupils doing third and fourth grade work could scarcely be classed as feeble-minded. The conclusion announced was that "we do not seem to have found any considerable number of feeble-minded school children who are able to do third grade work successfully, except in one or two branches. The possible pedagogical attainments of the majority of them have varied from decidedly less than kindergarten standard to second grade standard.*

*The Pedagogical Status of the Feeble-Minded School Children, *The Elementary School Journal*, 1918, pp. 588-597.
The Achievement of Mental Defectives in Standardized Educational Tests, *School and Society*, 1919, pp. 250-256.

Our study of the reading potentialities of the highest grade of the feeble-minded reemphasizes the same important practical conclusion reached in considering spelling: pupils who are capable of doing work in reading equal to or above the third grade standard should not be assigned to special classes for the mentally defective but to ungraded classes when it is possible to establish such classes. Exceptions to this rule would include mental defectives who have special talents in reading. We have found a few such cases but we did not find a single mental defective among those examined who possessed any remarkable talent in reading, although such instances have been reported in the literature.

- 6 The mentally defective and subnormal children, although averaging 3 or 4 years older in each grade, required from one and a third to three times as much time to read the paragraphs in the Gray scale, while they made from one and a half to seven times as many errors, as the normal pupils in corresponding grades.
- 7 The girls surpassed the boys in the reading test, the superiority amounting to 29% when based upon general averages for all the special school pupils (Table XIII), and 23% when based on general averages for all the examined pupils. The same result has been found among normal pupils. The girls proved to be superior to the boys when the reading test was given to the regular grades in the St. Louis schools.

In harmony with the finding that girls are more proficient than boys in reading is the correlative fact that the vast majority of children subject to word blindness are boys (See *Congenital Word Blindness*, *The Training School Bulletin*, 1920, 76ff, 93ff), while the majority of speech defectives are also boys (See *Report on Speech Defectives in the St. Louis Schools*, *Report of the Board of Education for the year 1915-1916*, pp. 174-211). The data are not available for an adequate explanation of these facts, although various hypotheses have been suggested.

- 8 Subnormal and mentally defective children show marked individual variation in reading capacity. Our results indicate that when pupils are graded homogeneously as to intelligence age the variability amounts to more than half the mean score in most of the ages. The variability in the lower grades (but above the first grade) among the normal pupils is only from one-half to one-fifth as large as the variability in the different B.-S. ages from VI to IX. It is possible, of course, that the variability among the subnormal children is smaller in the grade classification than in the B.-S. There are children in all B.-S. ages except age X who completely fail in the test.

We find numerous children with conspicuous defects in reading, out of all proportion to their intelligence or their status in one or more of the other literary branches, and others with special ability in reading, although the pupils with marked ability were not very numerous among those who were given the test.

- 9 Among the pupils who showed special ability in reading, relative to their intelligence level and ability in other branches, are included two of three Mongolians who were tested. Mongolians are conspicuously crude in motor co-ordination, and frequently do their best work in reading.
- 10 All of the four pupils referred to in this section and in the section on spelling as having made conspicuously poor records in reading had been diagnosed as cases of visual aphasia or dyslexia. All of these pupils were boys. One had been diagnosed as backward (number Ten), one as very backward or border-

line(number Eleven), and two as borderline(numbers Twenty-four and Twenty-five). All except one were also conspicuously poor in spelling, while one did somewhat better in spelling. We have frequently found with other cases of word-blindness that deficiency in spelling ability accompanies the deficiency in reading ability. Naturally this is to be expected so far as concerns written spelling. But all of those who have been poor in written spelling *whom we have tested orally* have also been poor in oral spelling. This must be more than a coincidence. We are not ready to say that this is due to the fact that weakness in visual word imagery is paralleled by a weakness in auditory word imagery, interfering with the ability to combine letters into words. It may be remarked that all of these pupils were better in oral than in written language. Three were better in number work than in reading or spelling while we have no data on the other pupil. As is well known, visual aphasia usually does not involve number symbols in addition to word or letter symbols. Nevertheless instances of total asymboly are not lacking.

- 11 It is perfectly obvious that our results do not justify the sweeping claim which has been constantly put forth by some advocates of the use of intelligence tests, that children should be placed in the school grade corresponding to their intelligence age. The assumption is that when there is a discrepancy between the school classification and the intelligence age, the school grading is all wrong and the child should be demoted or promoted according as he has been graded too high or too low as determined by his intelligence level. While this principle is no doubt frequently valid and while classification according to intelligence age is superior to classification according to chronological age, yet the fallacy of the dogma when uncritically applied is obvious without extended refutation. Some children have specific defects which interfere with the acquisition of certain types of subject-matter, while others have specific abilities which facilitate certain types of acquisition. Some are energetic, industrious, ambitious, others apathetic, inert, and indolent. It is evident that all types cannot be satisfactorily classified in their school work on the basis of a general intelligence score. Obviously they must be classified in at least certain subjects according to their specific abilities and disabilities (especially). We are constantly required to assign some children according to their stage of instruction rather than according to their intelligence age. However given a high intelligence index and no special disabilities, our constant aim should be so to expedite the child's promotion that the school grading will rapidly approximate the intelligence level.
- 12 Our findings with respect to word-blindness reported here and elsewhere* are of great practical importance. We do not recall ever to have read a single psychological, psychopathic or educational (not even in reading) survey of children made in the public schools of this country—and there have been surveys a plenty during the last few years, in which any suggestion was conveyed that some of the pupils might have been word-blind, or that the primary reason for the child's educational or intellectual inefficiency was word-blindness in some degree. Indeed so far as current educational practice in the vast majority of the schools of the country is concerned, visual aphasia and dyslexia are purely abstract, meaningless, academic concepts, of no consequence to the practical

*Meeting the Needs of the Mentally Handicapped Child in School, Ohio Bulletin of Charities and Correction, 1919, June; Congenital Word-Blindness—Some Analyses of Cases, The Training School Bulletin, 1920, 76ff. 93ff. The Problems Confronting a Psycho-Educational Clinic in a Large Municipality, Mental Hygiene, 1920, 103-136.

educator, classroom teacher, or psychological or educational testers. And yet our investigations have shown that many children have failed wretchedly in their school work primarily because of word-blindness, the word-blindness interfering with their acquisition of all types of subject-matter presented through visual verbal symbols, and that because of this affection they have frequently been assigned to classes for the feeble-minded when they have been normal or merely backward in intelligence, although the non-feeble-minded grades of word-blind children should be assigned to ungraded classes. In fact, it would be far better for the children and for the science of education if word-blind pupils of normal or near-normal intelligence were assigned to classes specifically restricted to such children where the corrective pedagogy of word-blindness would be intensively studied, and where, at any rate, the pupils could be given the advantages of oral presentations and of special mechanical, craft and artistic instruction when indicated. We would urge upon school administrators the great practical importance of affording children who are very poor in reading the advantages of a careful, expert examination in order to determine whether the primary defect is a defect in general intelligence, or a specific defect in visual word imagery, or a combination of the two. Fortunately auditory aphasia, or word deafness, a condition in which the child is unable to grasp, or grasps very feebly, the meaning of words *heard*, is far less common. We have found this condition in only one boy—cited in the chapter on the arithmetic test, and he is not a very clear case because of other complications,—among the thousands of children whom we have individually examined during the last decade.

- 13 For the purpose of measuring the reading achievement of subnormal and mentally defective pupils assigned to special classes Gray's scheme of weighted credits has not proved very satisfactory: first, because of the initial difficulty of assigning a correct grade classification to the child; second, because our groupings according to intelligence age and diagnosis contain pupils classified in various grades according to reading, in consequence of which the basis of scoring the reading records may differ widely for the pupils in the same grouping, so that the tendencies which we wish to trace may thereby be concealed or be distorted; and, third, the raw scores give an erroneous conception of the improvement of normal pupils from grade to grade (and of subnormals also), unless correction or allowance is made for the extra credits given in the lower grades, which at best involves a cumbersome process.

CHAPTER III.

THE ACHIEVEMENT OF SUBNORMAL PUPILS IN THE SPIRAL ARITHMETIC EXERCISES

The arithmetic test, given by the teacher who gave the reading test, was administered between Jan. 28 and Feb. 8, 1918. The pupils were tested in groups in one of the regular school rooms and were so seated as to prevent copying. The timing was made by a stop-watch, and pains were taken scrupulously to adhere to the time limits.

The grade classification was made by the special school teachers on the basis of the pupil's performance in the daily arithmetic work. Two hundred and thirty-three pupils (159 boys and 74 girls) were tested, while the enrollment on February 1 was 272. Some pupils not tested were absent, but the majority who were not tested were reported by the classroom teachers to be incapable of doing the tests. They were rated as doing kindergarten or sub-kindergarten work. Only one pupil (case Twenty-eight) who classified lower than the first grade was given the exercises. She made 4, 4 and 3 attempts in exercises A, B, and C, but failed completely on all. She was ten years old at the time and had been in school three and a half years. At the age of 9, she graded VI years by the 1908 and 5.6 (I. Q. 62) by the 1911 B.-S. scale, and about five and a half by the Seguin and was classified as a potential moron. On the other hand, one boy who graded 2.4 by B.-S. at the time of the B.-S. examination, one boy who graded 3.4, and four pupils who classified in the four year group were able to do some examples in some of the exercises. We shall give the records of the first two of these cases.

Case Twenty-nine (an American, born in St. Louis) who graded 2.4 at the age of 7.6 was of much higher intelligence than the B.-S. examination indicates. He was referred to the clinic because "he makes little progress in school." He has been in school one and three-fourths years, one and a half in the kindergarten, and at the age of seven and a half is unable to do I'. He is good in handwork. He plays with boys like a normal boy. He is generally a normal child. His greatest trouble is in language and speech. The kindergarten teachers only got broken phrases from him. I suspect that the trouble is due to hearing. A brother finished the eighth grade and a sister is now (March, 1917) in the sixth grade, both rather poor pupils.

The history indicates that he was born on time, the third child, the father being 38 and the mother 26 at the time of birth, neither addicted to drink, while the family history was reported negative. He had chicken pox at 2 years, measles at 3, and whooping cough at 4. There was little delay in early development except in speech and dentition. First dentition was at 13 months, he sat at 6, stood, took his first steps and walked at 14 months, used single words at 2 years, but did not use short phrases until he was 7 years. He had made use of the sign language. Examined at a hospital he was said to be "all right," while at a later examination in a medical school clinic he was pronounced "all right, but slow." The school medical examiner reported "that he had a slight tremor of the tongue, that he could not raise the tip over the lip, that he does not seem to be able to speak, but nods the head and makes a few sounds when asked to speak, that he cannot hear ordinary sounds and is a deaf-mute." The writer's examination disclosed tremors of the fingers and tongue, but in neither case were they pronounced. He was able to move his tongue fairly well in all directions. He respond-

ed to the Rinne and the ordinary fork test. His mother said that he could hear, as he would come down stairs when called from the first floor, under conditions precluding the possibility of lip reading. During our Binet examination (age 7.6) it was evident that the boy was watching our lips and facial expressions. Nevertheless we reached the conclusion that although partially deaf he could hear but that he failed to understand some of the words which he could hear. We felt quite certain that he heard our voice but did not always comprehend the words, and that he was unable to express himself in words. He imitated gestures readily, repeated two digits from memory, but when three numbers were used he responded before the experimenter got through. "It is cold and snowing" was reproduced as, "cold and snow." "My dog's name is Fido," was given as "Dog's name is Fido," and "In summer it is warm," became "ummer it is warm." He counted four pennies (his mother said he could count to 10), and named a penny and a nickel, but when asked what a key and a knife were he only made imitative movements. He was much interested in the pictures, but would not respond to the questions. He pointed twice to objects in one picture. He would make no response when asked where his nose, eyes and mouth were. He failed on the 3- and 12-gram weight discrimination test and the test on the designation of the longer line, evidently because he did not understand the verbal instructions. He pointed to the right line twice and to the wrong line three times. He made no response to the question whether he was a boy or a girl. Asked emphatically if he was a girl, he merely shook his head. He did the Healy mare-and-foal form board in 20 moves and 1 minute 35 seconds (seven mistakes), and the Seguin form board in 17 seconds (best of three, one error), which is better than age nine according to the combined norms and equal to about eight years according to the writer's norms. A tentative diagnosis was made of impaired hearing, not amounting to deafness, associated with partial congenital motor aphasia, (inability to learn to speak because of a lesion in Broca's convolution), and partial congenital auditory aphasia, or, as it is also called, word-deafness, or sensory aphasia, or verbal amnesia (inability to understand heard words, because of a defect in the first temporo-sphenoidal lobe), the intelligence diagnosis being deferred. He was recommended for examination by an expert otologist and for assignment to a school for pupils with speech and hearing defects, but, because of the impossibility of transferring him to this school, he was assigned to a special class for mental defectives. The recommendation that he should have his ears examined by an otologist was again made a year later, but without result.

In March, 1918, we asked the principal of the adjoining elementary school to test the boy's ability to hear and comprehend spoken language. He reported that he "hears noises and spoken words, but he does not seem to apprehend spoken words well." Later in the month we asked his teacher to send us the results of a number of observations and tests. He had then received individual instructions for almost a year. The answers indicated that he could use about 70 words in conversation, but he speaks only in short phrases of two or three words ("*play ball*," "*play marbles*," "*boy got ball*," "*boy hit me*," "*read to papa*,") and prefers to use gestures or signs. He properly named 24 objects from pictures, but could not name a leaf, towel, chair, teeth, hoe, hammer, frog, or sled (but he went through the motions of coasting). He is able to imitate spoken words fairly well, but says "*dirl*" for girl, "*wun*" for run, "*chitty*" for chicken, "*tan*" for can, "*gween*" for green. He has no trouble with *p*, *b*, *d*, *l*, *p*, *s*, *t*, and *w*, and is now able to get *m*, but the other consonants are difficult. His understanding of spoken words seems to be limited, but he understands, among others, the following words and phrases: *run*, *hop*, *jump*, *see*, *recess*, *boy*, *girl*, *kitty*, *sister*, *bird*, *baby*, *paper*, *pencil*, *catch*, *horse*, *chicken*, *play ball*, *come on*, *go home*, *get the ball*, *catch it*, *throw it*. He properly executed the following verbal commands: "put the scissors in the

drawer; "give me two books;" "bring five pieces of chalk;" "give me a pencil;" "put this basket on the piano." He reads poorly new matter from the primer, and writes primer work from dictation. He hears a moderate tone of voice when attentive. Otherwise he may not hear shouts. His hearing varies from day to day.

In May, 1918, the writer gave him some tests in school. He pointed to and named in pictures a cat "*titty*," hen "*ticken*," bird, girl "*dirl*," dog "*Tripp*" and ball. He seemed to call a cow a "bird" but at the conclusion of the test it sounded more like "bull." Asked where the word *ball* occurred in a primer he pointed to "Ben." "Run, Ben, run" were read as "*Run, ball, run*." "Get the ball, Ben," produced the inarticulate reproduction of "*the ball*." He read "*This is a ball*" correctly, although the word "*this*" was indistinct. He correctly read "*See this dog*." To the dictation, "the cat plays," he wrote: "*the play*." It was observed that he watched the experimenter's lips, hence the experimenter dictated "the dog runs" aloud in each of his ears several times, but he wrote nothing. After being allowed to look at the experimenter's lips he wrote: "*scoled the*." When the sentence, "I can play ball," was dictated in a loud voice near to his left ear, he wrote: "*I like play hull*." Taking precautions that he should not read our lips, we asked him to write 5. He did nothing until shown the 5. He was then asked to write 10, then 8, then 6, and finally 1, but only wrote 6 for 10. Permitted to look at our face, he was asked in succession to write each of the following digits: 4, 7 2, 10, 9, 8, 2. He wrote 14, 17, 12, and 10. Possibly some of his ones were intended to be strokes between the figures. When we dictated in succession, A, C, E, D, he wrote 1, 8, 1, 6. When we dictated, O, I, he wrote nothing. After we had dictated "ball" several times without success, we showed him a ball, and he wrote "*hull*." We dictated "book" several times, and finally showed him a book, but he wrote nothing. He wrote "*play*" properly from dictation, and also "*doll*" when a doll was dictated and also shown. He wrote "*sing*" for the dictation, "see the doll." When told to write all the words he knew he only shrugged his shoulders. In the tests of hearing we found that he habitually tended to turn his eyes toward the speaker, but some at least, of the numbers spoken aloud at close range, were heard under conditions precluding lip reading. Judging by his general reaction we inferred that he was able to hear loud sounds at a distance of fifteen feet, but he only reproduced a couple of words correctly. He was told to go to the black board in a matter of fact way in fairly loud tones, and without the use of gestures, but he made no response except to mutter something that was unintelligible to the experimenter.

In the spiral arithmetic exercises he did two examples in A and one in E, while he was not given Starch or Ayres spelling tests or the Gray oral reading test, because of reported incapacity in reading and spelling.

In the June, 1918, report from the special school he was reported "poor" in the identification of sounds, "fair" in physical training, but "poor" in rhythm, "fair" in the use of tools in wood work, and "fair" in drawing, but "poor" in raffia, stitched basketry, spelling and reading, though he had made some progress in all, he has made slight improvement in articulation and marked improvement in writing, and he observes fairly well but his attention wavers. His conduct is good and his best results are in handwork. The most significant improvement, noted in the June, 1919, report, is in the accuracy of his wood work. He has developed better form in drawing and writing, in which he was given a second grade and first quarter rating. In reading he was rated I-4, in writing from dictation I-2 (no improvement), in oral and written spelling I-3, in arithmetic I-3, while in naming objects in the room and in pictures, he was poor, having shown little improvement. He had shown a little improvement in enunciation as a result of articulation drills.

In December, 1919, we secured an examination of the boy by Dr. Louis K. Guggenheim, an expert otologist, who found a slight retraction of the drum membranes, irritation of the muco-cutaneous junction of the anterior nares, and adenoids which did not obstruct sufficiently to require an operation. The hearing was considered to be fair. Dr. Guggenheim also believes that the boy suffers from an undeveloped auditory verbal center (Wernicke's center). After having studied this boy for several years, we are satisfied that he is subnormal in general intelligence and subject to a considerable degree of word-deafness. But the subnormality does not amount to imbecility. Many word-deaf cases appear like idiots or imbeciles; perhaps most are mistaken for imbeciles. Burr believes that the "wild children" recorded in the past were strayed aphasics.

In the majority of Starr's fifty cases of word-deafness, as in our case, the power to name objects or to talk coherently was impaired, indicating that speech proceeds from auditory cues in many individuals. It is possible that there might be no impairment of speech from a defective hearing center in the case of individuals whose articulation proceeds from ideas of the appearance of objects or of their printed names, instead of from auditory images. Such persons will not be aphasic but mentally deaf: they will find it difficult to understand speech.

Arno Muller reports three subjects with apparent agraphia (inability to learn to write because of lesion in the left middle frontal gyrus, or in a sensory area, e. g., Wernicke's sensory area, which furnishes the cue for writing movements) all of whom were found to be hard of hearing. All responded, although slowly, to the ear treatment prescribed. When the hearing is poor it is probable that the pathways between the acoustic-visual speech and writing centers are impaired. Impairment of hearing would probably interfere with the proper storing of auditory images, and of the connection of the auditory images with the visual and motor (reading and writing). In the case of suspected auditory aphasia and dictation agraphia (inability to write from dictation) we should look to the subject's hearing and remedy, if possible, any defects found.

The pedagogy of word-deafness, because of its infrequency, has not been worked out in great detail. In general, to educate the auditory centers we must resort mainly to articulation drills and lip-reading. Once the word-deaf have been started on the right educational tract, many acquire lip-reading, reading and writing. They acquire this more easily than the understanding of spoken language. Word-deaf cases, however, probably improve less (at least so far as the understanding of speech is concerned) than word-blind or agraphia cases, according to the opinion of Kerr.

Case Thirty, who graded 3.4 by the 1908 and 4.2 by the 1911 B.-S. scale at the age of 9.4, had very defective speech and hearing. It was difficult to test him by the B.-S. both because of this and because of his reticence and refusal to respond. In the Seguin form board he graded about seven and a half years by the combined norms and less than seven by the writer's norms. It was our judgment that the form board record located his intelligence level more correctly than the B.-S. record. The diagnosis was deferred, although it was felt that he was probably feeble-minded through an attack of meningitis at the age of one year. He did not learn to talk until two years after this attack. In the special school he was very phlegmatic and reticent at first. In the June, 1918, report at the age of 12 he was rated as doing second grade first quarter work in drawing and writing, first grade fourth quarter in reading and spelling and second grade first quarter in arithmetic and was said to have made the greatest progress in industrial work. In the spiral arithmetic tests in 1918, when he was almost 12 years old, he did 8 examples in A (addition), 6 in B (subtraction), 3 in D (division), 2 in E (addition) and 3 in F (subtraction). In the latter test he did as well as the

normal third grade pupils. It is impossible to rate him in the other tests because of the inadequacy of the norms. He made no score in the Gray reading test, spelled seven words in Starch II and none in I, and 2, 4, 7, 9, and 13 words in Ayres A to E, respectively. The school record indicates that he is mentally defective, but he certainly is of higher intelligence than the B.-S. age would indicate.

THE RELATION OF ARITHMETICAL ACHIEVEMENT TO ASCENDING GRADE, B.-S. AGE AND DIAGNOSIS

The analysis will be confined to the average number of rights (and the medium number when given) for the two sexes combined.

There is a very patent increase, Table XX, from grade to grade, in all the exercises without exception, from A to G; and also in J, addition of 13 1-place digits; in K, division of two digits into three or four digits in L, multiplication of four digits by two digits; and in M, addition of five 4-place digits.

Owing to the number of exercises it would require too much space to give the amount of improvement from grade to grade. The figures from which such a computation can be made are available in the table. We shall, however, give the percentage of improvement for some of the exercises in the section in which the results are compared with the normal pupils.

The problems in fractions (H and O), even those requiring no change of denominator, were entirely too difficult for these pupils. The average number of examples solved by the whole group was only .05 in H and .01 in O. In fact only one boy (in the third grade) did any examples in H and only one boy in O (in the fourth grade). The boy who did fractions in O (dyslexia case, number Eleven) curiously failed entirely on the fractions in H. The record shows that he was able to divide and multiply fractions in O, but could not add or subtract fractions. The examples in H are in the addition and subtraction of fractions.

In I, division of one digit into five digits, and in N, division of two digits into five digits, there is an insignificant increase except in grade IV, although the fourth grade pupils attempted more examples than the pupils in any of the other grades. These tests, however, proved too difficult for these pupils. Only three pupils solved any examples in N, and only 19 in I.

As shown in Table XX, the amount of time in school, the chronological age at the time of the arithmetic test, and the intelligence age at the time of the B.-S. examination increase slightly from grade to grade, except that the length of schooling is the same for the second and third grade pupils. The difference in the intelligence age from grade to grade amounts to almost exactly one year, thus almost precisely paralleling the assumed difference in normal chronological ages between the grades.

The medians, Table XXI, are usually lower than the averages. Out of 60 possible comparisons between the medians and averages in the corresponding exercises in the same grade, the medians are lower in 41, higher in 11 and equal in 8 instances. The medians are zero in all the exercises in the first grade except A; in all the exercises in the second grade except A to E and G; in exercises H, I, K, L, N, and O of the third grade; and in exercises H, I, N, and O of the fourth grade.

The increase in the median scores in the different exercises from grade to grade occurs with only one exception, if we disregarded the instances in which the scores are zero and therefore equal.

TABLE XX
NUMBER OF ATTEMPTS (A) AND RIGHTS (R) IN ARITHMETIC EXERCISES ACCORDING TO GRADE.

Sex	No.	Chron. Age at Time of Test		Age	School	A		B		C		D		E		F		G		H		I		J		K		L		M		N		O						
		B.S.	Arith. Test			A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R									
Grade I																																								
Boys	58	10.41	11.62	54.4	96	5.5	3.13	2.7	1.79	2.43	1.18	1.0	.65	1.13	.77	.55	.15	.6	.17	0	0	.05	.01	.81	.19	.060	.2	0	29	.010	0	0	0	0						
Girls	30	10.57	12.16	24.4	35	3.76	3.9	2.24	1.66	1.56	.76	.56	.36	.96	.56	.33	.1	.33	.660	0	0	.03	.00	1.6	.2	0	0	36	.060	0	0	0	0							
Both	88	10.46	11.82	64.4	76	5.04	3.31	2.55	1.75	2.02	1.04	.85	.55	1.07	.70	.47	.13	.51	.130	0	0	.04	.01	1.07	.19	.040	.130	0	.31	.030	0	0	0							
Grade II																																								
Boys	70	11.17	12.92	57.5	59	9.55	8.24	6.09	4.44	5.26	4.06	4.3	3.1	2.55	1.97	2.26	.71	.01	.850	0	0	.37	.14	.82	.88	.3	.02	.75	.07	1.85	.58	.310	0	0						
Girls	30	11.62	13.25	11.6	28	8.6	7.8	4.6	3.6	4.43	3.13	3.1	2.36	.7	2.06	1.7	.76	.96	.8	.530	.2	.03	.1	.46	.76	.060	.43	.13	.73	.53	.03	.030	0	0						
Both	100	11.21	13.02	73.5	79	9.11	8.12	5.61	4.19	5.01	3.8	3.94	2.82	.6	2	.2	.07	.732	.84	.160	.32	.11	.72	.85	.23	.02	.66	.09	1.82	.57	.23	.010	0	0						
Grade III																																								
Boys	28	11.15	13.33	52.5	60	11.3	10.5	9.8	9.3	6.7	4.85	6.25	5.43	96.2	71.4	.032	3.6	1	.75	.71	.47	1.21	.39	.3	.2	1.07	.1	.46	.84	3	1.84	3	.53	0	150					
Girls	13	12.57	14.18	35.6	92	9.2	8.53	6.46	5.53	6.23	5.46	4.3	4	2.53	3.1	.92	.84	.2	.76	.230	1	.3	.2	1.07	.1	.46	.84	3	1.84	3	.53	0	150							
Both	41	11.55	13.7	8.475	76	10.7	9.2	8.75	8.34	6.58	5.04	5.9	4	97.3	92.2	.583	361	.632	.651	.55	.31	1.14	.36	.87	1.92	.1	.26	6	1.36	.412	.7	1.09	.6	.340						
Grade IV																																								
Boys	313	07	15	169	667	1822	21	6	18.	17.	16.615.	14.3	13.35	0	5	6	4.5	3	6	2.3	1	6	0	1	.6	.335	.663	.333	0	2.663	3	1	6	5	2.66	1	3	0	3.	1.3
General Averages for all Grades																																								
Boys	159	8.44	12.56	69.1	11	8.58	7	5.7	4.56	4.7	3.37	3.62	2.81	2	1	.722	.81	1	.68	.79	.15	.08	.79	.14	.78	.92	.45	.18	.75	.14	1	.56	.56	.27	.01	.13	.02			
Girls	74	8.21	12.95	92.3	89	6.87	6.25	4	3.10	3.56	2.54	2.37	1.81	.92	.1	.16	.5	1	.31	.48	.250	.1	.59	.06	.59	.58	.20	.08	.32	.10	17	.294	.10	.01	.02	.00				
Both	233	8.37	12.70	84.4	98	8.04	6.76	5.16	4	4	3.3	3.1	3.23	.492	.121	.64	1.75	.71	.57	.63	.18	.05	.72	.12	.72	.81	.37	.15	.61	.13	1	.44	.48	.22	.01	.02	.01			

TABLE XXI
NUMBER OF RIGHTS IN ARITHMETIC EXERCISES (MEDIAN) ACCORDING TO GRADE

Sex	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Grade I.															
Boys.....	4.5	0	.5	0	0	0	0	0	0	0	0	0	0	0	0
Girls.....	3.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Both.....	3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grade II.															
Boys.....	8	4	3	2	2	0	1	0	0	0	0	0	0	0	0
Girls.....	7	2.5	2	1	1	0	0	0	0	0	0	0	0	0	0
Both.....	8	3.5	3	2	1	0	1	0	0	0	0	0	0	0	0
Grade III															
Boys.....	11	8	5	4	2.5	1	1	0	0	2	0	0	1	0	0
Girls.....	8	4	4	3	3	0	1	0	0	1	0	0	0	0	0
Both.....	10	7	5	4	3	1	1	0	0	2	0	0	1	0	0
Grade IV															
Boys.....	25	15	13	15	4	6	3	0	0	3	4	2	3	0	0

It is evident, however, from the large number of zero scores that all of the exercises except the first five or six are too difficult to make it possible to measure improvement from grade to grade among these pupils by means of the medians.

We have already pointed out that the pupils who graded in the II- and III-year B.-S. classification, in Table XXII, actually rated higher in intelligence than indicated by the B.-S. age. In analyzing the data in this table we shall ignore these two ages.

Only one pupil, a X-year old boy, classified as very backward or borderline in intelligence, who was subject to dyslexia (number Eleven, discussed in the section on spelling), solved any of the examples in O, fractions. In H, addition and subtraction of fractions, only one boy, in age VIII, made any score.

Only 3 boys in age VII, 6 in VIII, 2 in IX and one in X, and one girl in VIII (13 pupils,) made any score in K, division of 3 or 4 digits by 2 digits. In I, the division 5 digits by one digit, presumably somewhat easier, scores were made by only one boy each in V and VII, 9 boys and 2 girls in VIII and 2 boys and 1 girl in IX (16 pupils). In N, division of five digits by two digits, only one boy and one girl in age VII and one boy in age VIII made a single score. It is even more apparent from the clinic group that the fraction and division examples were entirely too difficult.

In G, multiplication of four digits by one digit, no examples were solved in any age under VII, except by one boy in V and 3 boys in VI. In VII, ten boys and girls each succeeded, while above VII 35 boys and 5 girls solved examples. In L, multiplication of 4 digits by 2 digits, only one VII-year old girl made a score, while only 9 boys and 2 girls above VII succeeded. The number of attempts shows that many worked the problems incorrectly; some did not finish a single problem, while others gave no indication of having done anything. The same explanation applies to all of the other difficult tests.

In J, addition of 13 1-place digits, which requires a considerable attention span, only 5 boys in VI did any examples. The number of boys who did examples in ages VII to X was 9, 23, 5 and 1 respectively, and the number of girls from VII to IX, 5, 6 and one (or 50 altogether). In M, addition of five 4-place digits, which involves carrying, only one boy in VI succeeded. The number who succeeded from VII to X among the boys is 4, 21, 5, and one, respectively, and among the girls from VII to IX, 3, 4 and one (or 39 altogether). Many pupils started but did not get time to finish one of these examples.

TABLE XXII
NUMBER OF ATTEMPTS (A) AND RIGHTS (R) IN ARITHMETIC EXERCISES ACCORDING TO B.S. AGE

NUMBER OF ATTEMPTS (40) AND RESULTS																																			
Sex	Chron. Age at Time of Test	E.S. Arith. Test	A		B		C		D		E		F		G		H		I		J		K		L		M		N		O				
			A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R	A	R					
Age II Boys ..	1 7.66	8.75	2.4	2 58	4	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Age III Boys ..	1 9.4	11.91	3.4	4 68	9	8	7	6	8	0	5	3	2	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Age IV Boys ..	2 7.6	10.87	4.2	4 78	4	4	2	0	5	1	0	0	.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Girls ..	2 8.08	11.16	4.2	2 83	4.5	4	1.5	1.5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Both ..	4 7 84	11.0	4.2	3 78	4.25	4	1.75	7.5	2.5	.25	.5	5	250	.250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Age V Boys ..	6 8.42	10.76	5.31	3 68	6.5	5.33	3.16	.33	2.16	.16	.66	.5	1.33	.66	.33	.33	.160	0	.16	.16	.5	0	0	0	0	0	0	0	0	0	0	0	0		
Girls ..	7 9.81	11.1	5.61	4.5	4.42	2.85	1.57	1.28	.42	.280	.85	.42	.420	.850	0	0	.850	0	0	1.850	0	0	0	0	0	0	1.570	0	0	0	0	0	0		
Both ..	13 9 17	10.8	5.474	0.9	5.38	3.76	3.0	1	1.69	.3	.46	.231	.107	.53	.380	.600	.070	0	.07	.071	.230	0	0	0	0	0	1.070	0	0	0	0	0	0		
Age VI Boys ..	27 9.77	11.53	6.514	3.9	5.67	5	2.96	1.82	3.27	1.44	1.07	.331	.104	.62	.770	.66	.180	0	.030	1.18	.29	.030	.030	.29	.030	0	0	0	0	0	0	0	0		
Girls ..	10 10 25	11.45	6.354	0.6	3.9	2.9	2.7	1.5	7	.3	.6	.4	.6	1	.4	0	3	0	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0		
Both ..	37 9.87	11.51	6.474	3.2	5.16	4.43	2.32	1.45	2.56	1.13	.94	.35	.91	.48	.670	.56	.130	0	.020	1.32	.21	.020	.020	.37	.020	0	0	0	0	0	0	0	0		
Age VII Boys ..	34 11.04	12	7.395	4.3	7.85	7.2	4.38	3.14	4.14	2.35	3.052	2.141	.381	.61	.291	.29	.440	0	.26	.021	.55	.5	.41	.08	.820	1.32	.26	.17	.020	0	0	0	0		
Girls ..	10 10 25	13.39	7.695	6.1	6.45	5.94	3.28	2.72	3.42	2.23	2.431	.761	.851	.381	.23	.611	.47	.66	.710	.040	1.23	.42	.040	.38	.041	.04	.28	.04	.040	0	0	0	0		
Both ..	55 11.4	12.5	7.4	5.52	7.3	6.72	4.14	2.98	3.5	2.3	2.812	.032	.031	.381	.47	.411	.36	.52	.270	.18	.011	.43	.47	.29	.05	.65	.031	.23	.27	.12	.030	0	0		
Age VIII Boys ..	45 11.99	13.28	8.415	6.7	9.42	8.73	7.22	6.15	5.71	4.66	4.733	.622	.642	.282	.531	.172	.151	.08	.22	.55	.261	.951	.22	.77	.311	.2	.242	.13	.82	.53	.020	0	0		
Girls ..	13 12 13	13.5	8.356	15.10	.46	10	5.67	4.76	5.67	3.92	3.842	.762	.612	.071	.53	.611	.76	.53	.380	.76	.231	.46	.76	.69	.3	.61	.232	.38	.3	0	0	0	0		
Both ..	58 12 02	13.35	8.4	5.9	9.65	9.01	6.87	5.84	5.7	4.5	4.533	.482	.632	.242	.311	.052	.06	.86	.25	.60	.251	.841	.12	.75	.311	.06	.242	.1	.72	.48	.010	0	0		
Age IX Boys ..	71 2 55	13.5	9.376	6.117	14.17	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14		
Girls ..	11 11 16	11.75	9.5	38.4	24	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14		
Both ..	81 2 37	13.25	9.326	58.18	17.87	14.25	13	12.62	11.38	11	9.874	.254	.124	.373	3.121	.85	.750	3.121	.85	1.37	.873	.622	.251	.621	.871	.254	1.22	.5	.750	1.5	0	0	0		
Age X Boys ..	113 4	15.25	10.27	78.13	13	10	10	12	12	8	8	4	4	6	6	4	5	0	1	0	5	4	4	4	1	0	3	1	1	0	9	4	0	0	
General Averages for all Ages	124 10 98	12.37	7.435	26	8.36	7.7	5.59	4.36	4.95	3.37	3.542	.642	.121	.621	.9	.751	.53	.71	.16	.05	.38	.161	.65	.78	.5	.2	.76	.151	.48	.51	.29	.01	.16	.03	
Boys ..	54 11 25	12.66	7.115	9	6.92	6.14	3.64	2.81	3.29	2.22	2.271	.681	.721	.251	.03	.441	.16	.38	.370	.22	.071	.48	.44	.2	.07	.33	.121	.27	.27	.09	.010	0	0	0	
Girls ..	178 11 06	12.46	7.335	24	7.91	7.23	5.0	3.83	4.44	3.02	3.152	.352	0	1	.511	.63	.651	.42	.61	.22	.03	.33	.131	.6	.67	.41	.16	.63	.141	.42	.44	.23	.01	0	0

*At time of arithmetic test

In F, subtraction of 3 digits from 3 or 4 digits, not one pupil worked a single example under age VII. The number of boys who solved examples in ages VII to X was 6, 23, 3 and one, respectively, and the number of girls from VII to IX, 5, 4 and 1, respectively. In all of the difficult tests the average score made is very small.

If we compare the score made in a given exercise in the different B-S ages, we find that there is a uniform improvement with rising B-S. age in only two exercises, C, multiplication of a 1-place by a 1-place figure, and G, multiplication of 4 digits by one digit (we are not considering ages II and III). The improvement, however, is fairly uniform in exercises A, B, D, and E. In three tests, H, N and O, there are more losses and equal scores than gains. In all cases where the scores are equal the pupils failed completely in the test. In two tests, B, subtraction and J, addition, there is improvement in five ascending ages and a loss in one. In tests F and K there were four gains and two equal scores; in A, D, E and I, four gains and two losses; in M, four gains, one loss and one equal; and in L, three gains, one loss and two equal. It is evident that the tendency to improve with increasing intelligence age among our mental defectives varies greatly for the different tests, but the gains are more frequent than the losses or the equal scores in all tests except H, L, N and O.

When the results are summated for all the exercises we find 56 instances of improvement from age to age, as against 16 losses and 18 equal scores. The chronological age of the pupils increases, although irregularly, with increasing B-S. age, while the amount of time spent in school increases without exception with each higher intelligence age.

It may also be readily inferred from what we have said that the amount of gain or loss between successive mental ages is sometimes quite negligible. For the first four tests, however, the amount of improvement between successive ages is very patent. This is shown by the following indices of improvement, obtained by dividing the score made in a test in one age into the score made in the same test in the next higher age:

Ages	V	VI	VII	VIII	IX
	IV	V	VI	VII	VIII
Test A:					
Index .....	.94	1.17	1.51	1.34	1.98
Test B:					
Index	1.33	1.45	2.05	1.95	2.22
Test C:					
Index	1.20	3.76	2.03	1.95	2.54
Test D:					
Index .....	.46	1.50	5.8	1.71	2.79

There are only two losses, and these are immaterial because of the limited number of subjects. The gains range from 17% to 480%, the median among the 18 indices amounting to 95%. The largest per cents of improvement are made from age VI to VII and from age VIII to IX. The gains are somewhat larger in lists B, C, and D than in A.

In considering the classification of the data according to the diagnosis, Table XXIII, we shall disregard the "deferred" category, for reasons given in connection with the reading test, and the normal category, which contains only one subject, the epileptic girl who was described in the section on the oral reading test (case Twenty-three)

TABLE XXIII
NUMBER OF ATTEMPTS (A) AND RIGHTS (R) IN ARITHMETIC EXERCISES ACCORDING TO DIAGNOSIS

Sex	Chron. Age at time of test	Chron. Age at time of test	A		B		C		D		E		F		G		H		I		J		K		L		M		N		O			
			A		B		C		D		E		F		G		H		I		J		K		L		M		N		O			
			A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
Imbeciles																																		
Boys	710.23	12.34	5.74	4.82	4.14	3.42	2.42	59.1	42.280	0.	.85	.42	140.	0.	0.	0.	0.	0.	0.	28	140.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.			
Girls	10.16	11.36	5.82	4.28	2.66	66	66	33	33	16	330	330	5	0.	660.	0.	0.	0.	0.	0.	0.	4.160.	0.	0.	0.	1.5	0.	0.	0.	0.	0.			
Both	1310.20	10.81	5.78	4.11	3.3	2.15	1.61	92	92	23	150	61	23	3	0.	3	0.	0.	0.	15	07	1.920.	0.	0.	0.	.84	0.	0.	0.	0.	0.			
Potential Morons																																		
Boys	41.9	92	10.72	6.12	3.45	5.25	25	75.3	25.1	3	75.1	1.25	.75	1.250.	1.25	.5	0.	0.	0.	0.	0	1.25	1.	0.	0.	1	.25	0.	0.	0.	0.			
Girls	30.52	11.08	5.9	3.53	2.66	.66	33	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0	0	0	0.	0.	0.	0.	0.	0.	0.	0.	0.			
Both	710.18	10.88	6.02	3.48	5.14	3.28	28	42.2	28	57.2	14	.57	1.	42	710.	.71	280.	0.	0.	0	0	71	.570.	0.	0.	0.	1	.42	14	0.	0.			
Morons																																		
Boys	3010.15	12.59	7.35	5.52	7.7	6.9	4.16	2.93	93.2	36.3	2	0.32	3.31	56.1	6.	3.31	33	5	0	26	03	1.7	6	3	.13	730.	1.2	.36	2	0.	0.			
Girls	2212.57	13.95	7.44	5.88	7.27	6.59	4.93	4	43.2	68.3	22.2	22	1.72	181	27	.63	1.72	.63	680	180	1.5	.54	.180	.220	.4	.09	1.36	.27	.09	.04	0.			
Both	5212.17	13.16	1.38	5.67	7.51	6.76	4.34	13	1.13	2	5	3.09	11.2	0.71	401	46	461	5	.55	280	.23	.01	.61	.57	.25	.07	.59	.03	1.32	.32	.19	.01	0.	
Potential Feeble-Minded																																		
Boys	2110.78	11.59	7.43	5.02	7.57	7.14	4.76	3.9	4.61	2.66	38.1	95.1	76.1	42.1	57	.42	1.28	.56	0	.09	.04	1.52	52	.570.	.8	.04	1.04	.19	.38	0.	0.			
Girls	910.41	11.4	7.29	4.99	7.11	6.22	4.41	55.2	43.2	11.2	66.1	88.1	44	55	.77	.11	.44	0	.11	.10	.88	.55	.220	.220	.63	.03	1.03	.26	.3	0.	0.			
Both	3010.67	11.51	7.39	4.62	7.43	6.86	4.63	2	3	96.2	5	2	33.1	86.1	8	1.43	1.26	.3	1.13	.5	10	.03	.33	.53	.460	.22	.03	26	.3	0.	0.			
Borderline																																		
Boys	3811.34	12.77	8.06	5.89	9.84	9.39	7.5	6.05	6.44	5	1.4	94.3	53.2	36.1	99.2	23.1	0.21	.98	94	.42	.18	52	.36	1.92	1.05	.44	.26	.89	.34	1.97	.76	.26	.02	.310.
Girls	611.7	13.5	8.11	5.59	8.16	8.16	4	3.35	3.32	1.61	66.2	5	1.82	1	161	.83	.83	160	.83	.5	.1	.16	.83	.66	.83	5	1.16	.16	.33	0.	0.			
Both	4411.39	12.87	8.07	5.71	9.61	9.22	7.15	8.16	25.4	84.4	36.3	36.2	381	90.2	2	1.04	1.58	.33	.38	.15	.56	.38	1.79	.93	.5	.31	.88	.36	1.79	.68	.27	.02	.270.	
Backward																																		
Boys	1710.25	12.99	8.14	5.59	10.73	9.28	237	88.6	17.4	94.5	284	11.2	7	2.293	351	.882	.58	1.23	290	.82	.172	3	1.35	.41	7	1.17	.29	2.47	.76	.05	.52	.23		
Girls	410.2	12.3	8.7	5.00	10.75	10.4	4	5.4	25.3	25.3	75.3	75.3	1	1.23	.735	0.	0.	0.	.76	.25	1.5	1.5	0	0	0	5	2	1	.61	.04	.42	.19		
Both	2110.24	12.86	8.0	5.20	10.19	9.47	426	.615	88.4	8.4	9	3.952	9	2.52	.951	.662	.19	.230	.230	.76	.192	.191	.38	1.14	.56	1.04	.33	2.38	1.	.61	.04	.42	.19	
Deferred																																		
Boys	71.9	11.21	5.51	4.71	6.4	5.42	42	1.57	3.71	0.	.85	.57	1.28	1.	.42	.28	.14	0.	.28	.28	.57	.14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
Girls	3.8	10.77	5.4	3.58	9.66	9.35	.665	.33	.33	1.0	.66	.66	1.31	.9	.3	.2	.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
Both	10.8	11.08	5.48	4.49	7.4	6.6	5.4	12.7	3.	1.0	.8	6	1.3	1.	.9	.3	.2	.1	0.	.2	.0	.4	1	0.	0.	0.	0.	0.	0.	0.	0.	0.		
Normal																																		
Girls	1.8	10.	7.8	4.63	7.	7.	3.	3.	1.	1	2.	2.	2.	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		

Comparing the scores in the same exercise in the different categories, we find 47 instances in which there is improvement with rising intelligence classification, 15 instances in which the scores are equal, usually because of complete failures, and 13 instances in which there are losses. Eight of the failures to show improvement or losses occur among the potential morons as compared with the imbeciles, and eleven among the potential feeble-minded as compared with the morons. The reason the potential morons did so poorly is probably due to the fact that while they rated a quarter of a year higher in general intelligence, they were about a year younger and had been in school over a third of a year less than the imbeciles. The reason the potential feeble-minded did poorer than the morons is similar. Although their intelligence level is the same they averaged 1.65 years younger, and had been in school a year less than the morons.

Disregarding the potential morons and potential feeble-minded, there are only 4 losses and 4 equal scores (all failures except one) as compared with 37 gains. The increase in B.S. and chronological age and in length of time in school with rising intelligence classification is uniform among these four categories, except in the backward classification compared with the borderline. The backward averaged about the same in chronological and mental age but had been half a year less in school. This may explain why half of the failures to show gains are among the backward cases.

While there is thus a very distinct improvement shown with ascending intelligence category, the amount of the improvement is not always large, particularly in the most difficult tests. In the four simplest tests the improvement is sometimes quite marked, as shown by the following indices of improvement, obtained by dividing the score found in a test in one category of intelligence into the score in the next higher category:

Category	Moron	Borderline	Borderline
	Imbecile	Moron	Backward
Test A: Index.....	3.14	1.36	1.02
Test B: Index.....	6.80	1.85	1.13
Test C: Index.....	10.8	1.93	.99
Test D: Index.....		1.11	1.17

The improvement cannot be computed in test D between the imbeciles and the morons because the imbeciles did not score. In only one instance is there a loss. The improvement varies from 2% to 930%. It is largest between the imbeciles and morons; and smallest between the borderline and backward, probably for the reason already advanced. In the fraction examples only one borderline pupil in H and only one backward pupil in O out of the entire number tested did any examples. No one classified as feeble-minded could do any test in fractions.

In N, division of two digits into five digits, only one boy each among the morons, borderline and backward made any scores. In H, division of two digits into 3 or 4 digits, only two moron boys, four borderline boys and one borderline girl, and 6 backward boys did any examples. In I, division of one digit into five digits, only one imbecile boy, one moron boy, one potential feeble-minded boy, 8 borderline boys and 2 borderline girls, and 2 backward boys, and 1 backward girl, or 16 out of the 178 pupils did any examples. In D, division of one digit into one or two digits, 2 potential-moron boys, 13 moron boys and 11 moron girls, 12 potential feeble-minded boys and 4 potential feeble-minded girls, 26 borderline boys and 3 borderline girls, 16 backward boys and 2 backward girls, and 2 deferred boys and 1 deferred girl, and the one normal girl did

any examples, or a total of 93 pupils. Clearly all the division tests were too difficult for the feeble-minded. Less than half of the morons were able to get any examples right in the easiest set, D. In fact, only in the latter test were a considerable preponderance of the backward and borderline able to score, although they averaged over twelve years of age and had been in school over five years.

In the subtraction tests the following number of pupils did examples: in test B, one digit from one digit or from two digits, imbeciles, 2 boys and one girl; potential morons, 2 boys; morons, 19 boys and 16 girls; potential feeble-minded, 15 boys and 5 girls; borderline, 33 boys and 6 girls; backward, 15 boys and 2 girls; deferred, 3 boys and 3 girls; and normal 1 girl, or a total of 123; in test, F, 3 digits from 3 or 4 digits, morons, 7 boys and 5 girls; potential feeble-minded, 4 boys; borderline, 14 boys and 4 girls; backward, 8 boys and 1 girl; deferred, 1 boy, or a total of 44. Obviously the more difficult subtraction examples, F, are too difficult for our highest grade of feeble-minded. Most of the morons, however, were able to do at least one example in the simpler set. A large preponderance of the borderline, potential feeble-minded and backward were able to score in the latter set.

In the multiplication tests the following number of pupils made some score: in test C, multiplication of one digit by one digit, imbeciles; one boy and one girl; potential morons, two boys; morons, 19 boys and 16 girls; potential feeble-minded, 16 boys and 5 girls; borderline, 32 boys and 5 girls; backward, 15 boys and 3 girls; deferred, 5 boys and 2 girls; and normal, one girl (123 pupils); in test G, potential morons, one boy; morons, 10 boys and 9 girls; potential feeble-minded, 10 boys and 1 girl; borderline, 18 boys and 3 girls; backward, 9 boys; deferred, 1 boy; and normal, 1 girl (63 pupils); and in test L, morons, 1 girl; potential feeble-minded, 1 boy; borderline, 5 boys and 1 girl; and backward, 3 boys and 1 girl (12 pupils). Only the simplest of the multiplication tests comes within the possibility of the majority of our highest grade mental defectives (morons), or a considerable preponderance of the potential feeble-minded, borderline or backward.

In the addition tests, the number making any scores was as follows; in test M, addition of five 4-place digits, potential morons, 1 boy; morons, 6 boys and 3 girls; potential feeble-minded, 2 boys and 3 girls; borderline, 14 boys and 1 girl; backward 3 boys and 1 girl; and deferred, 1 boy (or 40 pupils); in test J, addition of 13 1-place digits, potential morons, 2 boys; morons, 6 boys and 6 girls; potential feeble-minded, 7 boys and 3 girls; borderline, 17 boys and 1 girl; backward, 10 boys and 2 girls; and deferred, 1 boy (or 55); in test E, imbeciles, 2 boys; potential morons, 2 boys; morons, 21 boys and 15 girls; potential feeble-minded, 13 boys and 6 girls; borderline, 28 boys and 6 girls; backward, 16 boys and 2 girls; deferred, 4 boys and 2 girls; and normal, 1 girl (or 120). In test A, addition of two 1-place digits, all the pupils did one or more examples except 3 imbeciles, 1 potential moron, 1 potential feeble-minded and 2 borderline. The simplest addition test was the only test in which the majority of the imbeciles were able to make a score. It was decidedly the easiest test in the entire series. Only in tests A and E, however, was it possible for the majority of the potential morons, morons, and borderline to score. A majority of the backward also scored in J.

The imbeciles scored only in exercises A, B, C, E, and I, the easiest exercises in addition, subtraction, and multiplication, and the more difficult exercise in division, while the imbeciles were the only ones to fail entirely in M, addition of 5 4-place digits, which involves carrying; J, addition of 13 1-place digits, which requires a considerable attention span; G, multiplication of 4 digits by one digit; and D, the division of one digit into one or two digits. In J, 25 random attempts were made by two girls. Four

of the 13 imbeciles failed completely in all exercises, while 6 failed in all except one. Only one imbecile scored in as many as four exercises. It is evident that arithmetical work was beyond our mental defectives of the grade of imbeciles, who average 11.8 years of age and had been in school about four years, with the exception of the simplest exercises in addition.

SEX DIFFERENCES

There are more instances in which the boys' scores surpass the girls' scores than the reverse. In the grade classification the boys excel in 24 comparisons, the girls in 10, while the scores are equal in 11 of the 45 possible comparisons in grades I, II and III. In the general averages for all the boys and girls, the boys are superior in 14 exercises while the scores are equal in one exercise. In the B.-S. classification the boys excel in 31, the girls in 20, while the scores are equal in 39 of the 90 comparisons in ages IV to IX. In the general averages for the entire group, the boys excel in 14 exercises while the scores are equal in one. In the diagnosis classification, including all categories in which comparison can be made, the boys excel in 47 instances, the girls in 22, while the scores are equal in 36. The large number of equal scores is due to the large number who failed completely in the tests. While the differences between the scores of the boys and the girls are frequently trifling, yet the tendency of the boys to excel is sufficiently marked to be noticeable. The girls in these exercises are perhaps relatively weakest in division (I and J) and fractions (H and O). Unfortunately there are no figures available for these arithmetic exercises which make it possible to compare our results with the boys and girls in the regular grades in the St. Louis schools.

VARIABILITY

The analysis of the variability will be limited to pointing out the quartile deviation (Q) and range (R), based on the combined figures for the two sexes, in the grade classification.

It is evident from the detailed analyses which have preceded that both the quartile deviation and the range will be zero in some of these tests, especially in the lower grades, because they were entirely too difficult for all the pupils. Inspection of Table XXIV shows that some one in every grade failed in every test with the exception of tests B and C in grade III, and tests A to E, and J and M in grade IV.

If we confine our analysis to the four easiest examples, we find that the range is the greatest in test A, and that it decreases gradually from A to D, except in grade IV. It is natural that the range should decrease as the type of example grows more difficult when the lowest scores in every classification are zero or one, as is the case in the first three grades, because the more difficult the tests grows the smaller will be the highest scores. This, therefore, seems to indicate that the tests are properly arranged in the order of difficulty. The greatest range in all four exercises is in the second and third grades. In exercise A it amounts to 26 and 25 examples in these grades.

The most serviceable measure by which to estimate the amount of variability is the *relative* quartile deviation, which we obtain by dividing the central tendency (average) into the Q obtained from the same set of measurements. The following are the Q's in terms of per cents of the averages:

Grade	I	II	III
Test A.....	.75	.36	.42
Test B.....	.85	.59	.40
Test C.....	.48	.52	.54
Test D.....	.00	.86	.40

TABLE XXIV
THE Q AND R FOR THE ARITHMETIC EXERCISES ACCORDING TO GRADE

Sex	A		B		C		D		E		F		G		H		I		J		K		L		M		N		O	
	Q		R		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q	
	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R	Q	R
Grade I																														
Boys	2.75	0.13	1.5	0.10	.75	0.8	0.	0.7	1.	0.4	0	0.2	0.	0.2	0	0	0	0.1	0	0.2	0	0	0	0	0	0.1	0	0	0	0
Girls	2.25	0.12	1.25	0.11	.5	0.8	0.	0.6	.5	0.2	0.	0.2	0.	0.1	0	0	0	0	0	0.2	0	0	0	0	0	0.2	0	0	0	0
Both	2.5	0.13	1.5	0.11	.5	0.8	0.	0.7	.5	0.4	0.	0.2	0.	0.2	0	0	0	0.1	0	0.2	0	0	0	0	0	0.2	0	0	0	0
Grade II																														
Boys	3.	0.26	3.	0.20	2.25	0.14	2.25	0.13	1.	0.9	.75	0.4	.5	0.4	0	0	0	0.2	1.	0.4	0	0.1	0	0.2	.5	0.3	0	0	0	0
Girls	3.5	1.24	2.25	0.14	1.75	0.16	2.25	0.12	1.	0.8	.5	0.5	.75	0.3	0	0	0	0.1	.75	0.5	0	0	0	0.2	.5	0.4	0	0.1	0	0
Both	3.	0.26	2.5	0.20	2.	0.16	2.5	0.13	1.	0.9	.5	0.5	.5	0.4	0	0	0	0.2	1.	0.5	0	0.1	0	0.2	.5	0.4	0	0.1	0	0
Grade III																														
Boys	3.	0.25	3.5	1.20	3.	1.18	1.5	0.18	1.	0.5	1.5	0.8	1	0.6	0	0.7	0	0.5	.5	0.6	.5	0.4	0	0.3	1.5	0.4	0	0.1	0	0
Girls	5.	2.16	4.5	1.13	3.	1.12	3.	0.12	.5	0.3	1.	0.3	5	0.4	0	0	.12	0.2	1.	0.3	.12	0.4	0	0.3	.12	0.2	0	0	0	0
Both	3.87	0.25	3.37	1.20	2.75	1.18	2.	0.18	5	0.5	1.5	0.8	.5	0.6	0	0.7	0	0.5	1.	0.6	.5	0.4	0	0.3	1.	0.4	0	0.1	0	0
Grade IV																														
Boys	13.27		10.26		12.19	.....	8.17	.....	4.7		0.8	.....	0.4		0		0.1	.....	3.4	.....	0.4	.....	0.3	.....	1.4	.....	0		0.4	

The variability seems to be abnormally large. With one exception, the lowest variability is 36% of the average, while the highest is 86%. It is probable that the variability is considerably greater among mental defectives classified in the same grade than among pupils in the elementary schools classified in the same grade, but we shall not know definitely whether this is true until we have comparable data from the regular grades. Counts* has given the distribution of the scores for some of the tests, but all the figures except for one test appertain to pupils above the third grade and cannot be compared with our data.

There is a large number of very poor records, considering the subjects' level of intelligence, and a few rather superior records, although perhaps only one pupil can be said to have made a distinctly good record. The necessity for brevity makes it impossible for us to attempt anything like a detailed analysis of the records of these outstanding pupils. We shall refer merely to a few of those with the best and poorest records.

Eight pupils, varying by the B.-S. test from 7.8 to 9.8 years, did from 51 to 123 examples in all of the series. We shall resume briefly the record of the best pupil, because he represents a type of child who, on the basis of a standard of diagnosis once widely followed, has generally been assigned as mentally defective to a special school, and the records of three pupils who would clearly be "morons" on the basis of the standards widely advocated and followed in connection with the Stanford revision. We shall in each case give the designation of the arithmetic test by letter, the score in Arabic numerals and the normal grade equivalent in Roman numerals. A minus sign in front of the latter indicates that the score is somewhat lower than the grade indicated, and a plus sign that it is somewhat higher. Grades less than III^2 can only be given as $-\text{III}^2$, owing to the absence of norms below III^2 .

Case Thirty made the following record in the arithmetic exercises at the age of 15.8: A, 27, $-\text{VII}^2$; B, 26, $-\text{VIII}^2$; C, 19, VII^2 ; D, 17, $+\text{IV}^4$; E, 7, $-\text{VI}^4$; F, 8, VI^2 ; G, 3, $+\text{III}^2$; H, O; I, 1, $-\text{III}^2$; J, 3, III^4 ; K, 4, IV^4 ; L, 3, $-\text{V}^2$; M, 4, $-\text{VI}^2$; N, O.; and O.O. He failed in the tests on fractions and the difficult division test. In 3 tests he did only about third grade work, while in the remaining 9 tests he graded from fourth to eighth grade. In fact, he did from fifth to eighth grade work in almost half of the tests. In the Gray Oral reading test he made 57.5, based on fourth grade classification, which is higher than the raw scores in any of the elementary grades. He did not take the spelling tests. The last report from the special school, made in June, 1918, after he had been in the school two and a quarter years, indicated that he did fifth grade work in reading, and fourth grade work in spelling and arithmetic. In the latter he was "usually alert and accurate, but sometimes surprisingly stupid in problems."

At the time of the examination in the Clinic (December, 1915,) when he was 13.4 years old he graded 9.8 years by the 1908 scale, and 9.6 by the 1911 (I. Q. 71) and 12 years by the Seguin form board according to the combined norms and 11.4 according to the writer's norms. His percentiles were as follows: standing and sitting height, -5 and -0 ; weight, 0; spirometry, 0; and right and left grip, 0 and -5 . He was clearly under par physically. He was anemic and his tonsils were enlarged. A diagnosis of mental backwardness was made and he was recommended to an open air school. He was returned from this school, because his parents refused to pay for his lunch, to the grade school in March the following year, from which the request was made that he be sent to a special school because he did "not concentrate, and he was very nervous and troublesome." He was transferred to such a school solely because no ungraded class was available. The three annual reports which we have received from the

*As before, 36f.

special school have indicated that it would be advisable to give him the advantages of instruction in an ungraded class. It is important that ungraded classes, from which the feeble-minded are excluded, should be provided for pupils with the degree of intelligence possessed by this boy. They will necessarily be hampered in classes designed for mental defectives. Based on the results of the testing of a considerable number of subjects by both the Stanford and the old B.-S. scales, this boy would have graded lower by the Stanford scale, and according to the theoretically established Stanford norms he would have been "definitely feeble-minded." His two teachers in the special schools agree with the writer that he is not feeble-minded. Considering his degree of backwardness as measured by the B.-S. scale, he possesses considerable ability in both reading and arithmetic.

The three following subjects who were tested by the Stanford scale fell unequivocally below the line of "definite feeble-mindedness" by the Stanford scale and formula. On the basis of the low Stanford rating we classified the first pupil as a potential moron, the second as a moron, and the third as probably a moron. Had they been examined by the old scales, with which we had a much longer familiarity, and in the use of which we had learned to make various allowances in making intelligence diagnoses, we should probably have classified them as borderline. Such a classification, from the standpoint of the attempt to cautiously differentiate the grades of intelligence more sharply, would perhaps have been more in harmony with the pedagogical records of these pupils.

Case Thirty-one, at the age of 13 years, made the following record in the arithmetic exercises: A, 19,—IV²; B, 20, V⁴; C, 13,—IV²; D, 12, III⁴; E, 8,—VIII²; F, 2,—III²; G, 3,—III²; H, 0; I, 1,—III²; J, 3,—IV²; K, 0, L, I,—IV²; M, 3,—IV²; N, 0; and O, 0. He completely failed in the fraction and difficult division tests. In four tests he did third grade or slightly less than third grade work, while in seven tests he graded from about fourth grade to eight grade. In the Ayres spelling test he did between third and fourth grade work in I, and in L and O somewhat less than third grade. In the Gray reading test he scored 37.5, based on third grade classification, which is only equal to grade one. Had he been classified as of first grade, the score would have been considerably higher. However, he did better in arithmetic than in reading or spelling.

This boy came from Detroit, Michigan, and because of his prior classification was placed in a IV² class, but was unable to do the work. At the age of 12.58 he graded 8.5 by the Stanford (I. Q. 67) and 10.5 years by the Seguin form board according to the combined norms and 9.5 according to the writer's. Physically he was suffering from post-nasal obstruction and dental caries. His head was of the sugar loaf type, with a high forehead. After five months in the special school the report indicated that he was "very good" in physical culture, wood, brush, concrete and clay work and cobbling. He was graded III³ in all the literary branches. In arithmetic he was "very good in abstract work." His greatest improvement was in arithmetic. He made "great effort," and his conduct was "excellent." On the basis of the special school record and the higher intelligence rating which he undoubtedly would have secured from the older B.-S. scales we should not classify him lower than the borderline. At the same time, his ability in arithmetic, as determined by the tests, is higher than his ability in reading or spelling.

Case Thirty-two was referred to the Clinic from an ungraded class and from a class for troublesome boys to which he had been transferred before he could be examined. The complaint indicated that he was "unstable, erratic, untruthful, irresponsible, quarrelsome, cowardly, cruel, truant, covetous, and a consistent liar," although cheerful withal. He did first grade work in reading, between third and

fourth in arithmetic, and was very poor in spelling. In March, 1918, at 13.16 years of age he graded 8.66 years by the Stanford (I. Q. 65) and 9.2 by the Seguin according to the combined norms and 7.7 by the writer's norms. He filled in all except two holes in the Healy-Fernald form board B in one minute, but could not fill in these two holes in two more minutes. He required 2 minutes to read to "city" in the Stanford selection (17 words), but received aid on 11 words and only read *A, 5th, three, the, of*. He read correctly, "*I am a boy*," but "*I can run*" was read as "*I am run*." In the sentences "*I can hop*," "*I can jump*," "*I can sing*," he could only read the first two words. His spelling was abominable. He spelled foot as "*fu*," get as "*ca*," for, as "*forw*" and then "*for*," horse as "*hors*," cut, as "*cu*," well, as "*ye*," name as "*men*" and then "*ment*," room, as "*h*.....," left as "*fet*," and with, as "*went*." He spelled dog and cat correctly. He was not equal to second grade spelling. On the physical side he was subject to rhinitis, enuresis, possibly adenoids, and slightly enlarged lymph glands. His expression was coarse, and his palate high. He fell from a pile of ties at the age of 3 years and received scalp wounds. His record showed that he had been disobedient and truant in the past, more or less queer, and subject to emotional outbreaks.

In the special school he was reported to be sexually immoral, indifferent and quarrelsome, but made his greatest improvement in "disposition and interest."

Although he had made little effort he was keen to observe. He was rated as barely doing first grade work in reading but third grade work in arithmetic. He only took the arithmetic tests, in which, at the age of 13.3, he scored as follows; A, 12,—III²; B, 11,—III⁴; C, 10, III⁴; D, 5,—III²; E, 4,—III²; F, 1,—III²; G, 2,—III²; H, 0; I, 0; J, 3, III⁴; K, 3,—IV²; L, 0; M, 1,—III²; N, 0; and O, 0. He failed in five of the tests, while in the others he graded from somewhat less than third grade to fourth grade. There is no question that he was better in arithmetic than in reading or spelling. This pupil's condition had been diagnosed as visual aphasia plus psychopathic constitution plus feeble-mindedness. There may be some doubt about this boy's being feeble-minded, but we would not grade him above borderline in intelligence.

Case Thirty-three graded only 7.66 years by the Stanford scale in March, 1918, at the age of 13.16 and therefore seemed unquestionably feeble-minded according to the accepted standards (I.Q. 58). Further investigation showed, however, that, although born in St. Louis, she came from a home in which Italian was constantly spoken. Her English vocabulary, in spite of the fact that she had attended school five years (apparently public schools) was extremely meagre. She scored only 2520 in the Stanford vocabulary test. In the Seguin form board she graded distinctly higher, 11.2 by the combined norms and 10.4 by the writer's norms. She had been advanced in school to III⁴, and was said to do III² work. Her greatest defect was reported in language, and greatest interest in housekeeping. She was excellent in conduct. The principal adds that "these types do not get along in school, but they manage to get along fairly well out in life." The report from the special school two and a half months later indicated that she did III¹ in writing, II³ in reading, II¹ in oral and written language, II³ in spelling and III¹ in arithmetic. Her greatest ability was in manual work. She was of a very quiet disposition and good conduct. She was only given the arithmetic tests. Her scores at the age of 13.31 were: A, 14, III²; B, 11,—III⁴; C, 4,—III²; D, 8,—III²; E, 3,—III²; F, 5,—IV²; G, 3,—III⁴; H, 0; I, 0; J, 3, III⁴; K, 0; L, 2,—IV²; M, 3,—IV²; N, 1,—IV⁴; and O, 0. She failed in three exercises. In all the others she varied from somewhat less than third grade to IV⁴. It is probably true, in harmony with the teacher's rating, that she has greater ability in arithmetic than in language, reading and spelling. Be this as it may we probably are not justified in definitely diagnosing a girl like this as a "moron,"

until we have found out how she is able to adjust herself to the demands of life outside of the school during the period of the middle and later teens.

Mental defectives have always been considered to be conspicuously deficient in arithmetic. We shall only cite one instance in which we might be justified in saying that there was a specific arithmetical defect, although it is superposed on a background of considerable general mental retardation.

Case thirty-four, a very intelligent looking girl, but proving withal to be very apathetic, was examined in October, 1914, at the age of 10.16. By the 1908 she graded 7.6 years and by the 1911, 6.8 (I. Q. 66). She was peculiarly stupid in the Seguin form board, being obliged to constantly scrutinize the blocks and recesses, and placing many of the blocks in the wrong recesses. In the third trial she made 20 moves in inserting the blocks. She graded less than four years in this test. She had been in school 4 years, and advanced to the second grade. The mother said she was quick and bright and did not know there was anything wrong with her until she entered the kindergarten. Her tonsils were enormously enlarged. In spite of all the unfavorable elements, we felt that she would eventually go somewhat above the feeble-minded status and diagnosed her as borderline. We recommended the removal of the tonsils (which was not done until 1918) and assigned her to a special school. The first annual report, in June, 1915, indicated that her greatest capacity was in reading (almost II grade), that she was poor in written language, writing, drawing, all forms of handwork and arithmetic. She had made her greatest improvement in physical training. The last report from the school, June, 1918, indicated that her greatest capacity was still in reading (third grade), followed by spelling, while she was very poor in arithmetic, having made no improvement and not doing over first grade work in telling time, measuring, counting money, and counting, reading and writing numbers. She had improved in the physical training work and in manual activities, but she did not do very good work in either. At the age of about $13\frac{3}{4}$ years she did almost third grade work in Ayres I, between second and third in L, and considerably less than third in O. In the Starch columns her scores fell midway between the first and second grade standards. In the oral reading test she scored 32.5, based on a third grade classification, which is less than the third grade standard, or even the first grade standard. However, had she been given a lower classification she would have scored higher. In the arithmetic exercises she did only four examples in A, addition of one-place digits. The educational tests show not only that she is peculiarly deficient in arithmetic but that she does not grade as high in the standardized tests of reading and spelling as she had been rated in the school, and that she must be classed as mentally defective rather than borderline.

COMPARISON OF THE RECORDS OF THE MENTALLY DEFECTIVE AND NORMAL PUPILS

The following figures show the efficiency of the pupils in the special schools in terms of per cents of the efficiency of the pupils in the regular grades in the St. Louis schools.

THE EFFICIENCY OF THE SPECIAL SCHOOL PUPILS EXPRESSED AS PER CENTS OF THE NORMAL EFFICIENCY, AS EXPLAINED ABOVE

Test	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Grade III.....	.68	.70	.65	.44	.78	.43	37	—	—	1.25	=	=	2.0	=	=
Grade IV.....	1.17	.88	.84	.92	.74	1.0	58	—	—	.76	1.0	.68	.90	—	—
Morons.....	.46	.31	.32	.23	.36	.20	20	—	.009	.35	x	x	.64	x	=
Backward.....	.64	.66	.63	.43	.66	.72	37	—	.17	.86	x	x	2.0	x	x
B.-S. Age IX.....	.97	.06	.08	.80	.85	1.0	.52	—	.62	.77	x	x	1.19	=	=

A minus sign (—) indicates that the score for the special school pupils was zero and an X that it was zero for the grade pupils. An equality (=) sign indicates that the scores were zero for both groups.

The relative efficiency of the special school pupils is obtained by dividing the elementary school medians for grades III² into the special school medians for the pupils classified as of grade III (Table XXI), the elementary medians for grade IV⁴ into the special school medians for the pupils classified as of grade IV, the elementary medians for grade III² into the averages (the medians not having been computed) for the morons and backward pupils (Table XXIII), and the elementary medians for grade III⁴ into the averages for age IX (Table XXII). As we have already pointed out the medians in the special schools are lower than the averages in the corresponding grades with only a few exceptions.

It should be recalled that the tests in the elementary schools were given from two, to three months later in the year than the tests in the special schools, the conditions, therefore, being somewhat to the disadvantage of the special school pupils.

Aside from the tests which were too difficult for both groups, the third grade special school pupils were equal to or surpassed the III² normals in only two tests, addition of 13 one place digits, and addition of 5 four-place digits. The scores were small in both of these tests. In the other tests the efficiency of the special school pupils did not reach or exceed 70% of the normals' standard in more than two tests, subtraction of two one-place digits and addition of five one-place digits. The average age of the group at the time of the test was 13.7 and the average time in school 5.78 years. They were, therefore, considerably older and had been much longer in school, than the normal III² pupils. Seven of the pupils in this group who had been examined had been diagnosed as morons, 3 as potential feeble-minded, 12 as borderline and 6 as backward. Thirteen had not been examined.

The fourth grade specials equaled the normal IV⁴ only in subtraction of a 3-place figure from a 3- or 4-place figure, and in the division of a 3-place figure into a 3- or 4-place figure, and they surpassed the normals only in addition of 2 one-place digits. In two other tests they made 90% of the normal score, namely in the division of a one-place figure into a one- or two-place figure and addition of 5 four-place digits. In tests H, I, N, and O, the specials failed entirely (according to the medians). The average age of the special group at the time of the test was 15.16 years and the average number of years in school 7.18. Two of the pupils had been diagnosed as very backward and one as borderline.

It is evident that the subnormal pupils classified in the third and fourth grades in the special schools, of whom, however, the majority of those who had been examined had not been diagnosed as feeble-minded, are decidedly inferior in most of the exercises to the pupils in the regular III² and IV⁴ grades. The subnormal fourth grade pupils, however, were superior to the normal III⁴ pupils in ten exercises, inferior in four and equal in one.

The morons did decidedly poorer than the III² pupils in every test (disregarding tests K, L, N, and O, which were too hard for both group). The best score which they made in any test, addition of 5 four-place digits, was only 64% of the normal score. Their efficiency in seven of the tests varied from 20% to 36%. The absence of norms for grades I and II makes it impossible to express the status of the morons in accurate terms. The average age of the moron group at the time of the arithmetic test was 13.16 and the average number of years in school was 5.67, while the average mental age at the time of the B.S. examination was 7.38. Had the norms been available it is probable that the morons would not have done better than second grade work in the arithmetic tests. They would thus have required almost three years to do one year's work in arithmetic.

Except in the exercises in which the scores are so small as to be negligible (K, L, N, and O) the backward pupils did decidedly poorer than the normal III². Their best

performance was in the addition of 13 one-place digits, 86% of normal III² performance. In only three other tests did they equal or exceed 66% of normal III² efficiency, namely in subtraction of 2 one-place digits, addition of 5 one-place digits, and subtraction of a three-place digit from a three or four-place digit. The group averaged 12.86 years at the time of the arithmetic test, 5.2 years in school and 8 years in intelligence.

Of the mental age (B.-S.) categories we have selected the IX-year old group because, owing to the fact that there is only one X-year pupil (backward) they are the group with the highest mental level of the pupils who had been examined. The mental level at the time of the arithmetic test was, of course, somewhat higher, because some of the pupils were given the B.-S. tests a considerable time prior to the arithmetic test. Five of the IX-year olds had been classified as borderline, three as very backward and none as feeble-minded. As seen in Table XXII the IX-year olds did from two to three times better than the VIII-year olds in nearly all the arithmetic exercises.

The IX-year mentalities did better than the III⁴ in five tests, addition of 5 four-place digits, multiplication of 2 one-place digits and of one 2-place digit by one 4-place digit, subtraction of 2 one-place digits, and division of a two-place figure into a three or four-place figure. In one exercise, subtraction of a three-place figure from a three or four-place figure, they did just as well, and in one exercise, addition of 2 one place digits, they did almost as well. Therefore they did as well or better than the normal III⁴ in about half of the exercises. But they were considerably older and had been much longer in school. They averaged 13.25 years in chronological age at the time of the arithmetic test, and 6.58 years in school.

In which processes did the special school pupils make the best records relatively to the normal standards? And in which processes did they make the poorest records? These questions can be best answered by arranging the percentages in the tabulation on p. 81 in the order of excellence in each grouping, namely in grades III and IV, morons, backward and B.-S. age IX.

The special school pupils clearly made their best record, relatively to the performance of the normal pupils, in adding. The best record was made in test M, addition of five four-place digits in three of the groups in the tabulation on page 81, whereas test J, addition of 13 one-place figures, was the second best in two groups, test E, addition of 5 one-place digits, was the third best exercise in two groups, while test A, addition of 2 one-place digits, was the best exercise in one group, the second best in one and the third best in one.

The worst record in all groups was made in exercise H, the addition and subtraction of fractions. The other fraction test, O, was too difficult for both the normal and the subnormal groups. Next in the order of difficulty comes the process of division. In test I, the division of a one-place figure into a five-place figure, the second poorest record was made in four of the groups and the third poorest in one of the groups. Test N, the division of a 2-place figure into a 5-place figure, was too difficult for both groups, and test K, the division of a 2-place figure into a 3 or 4-place figure, was almost too difficult for each group. The easiest division test, D, the division of a 1-place figure into a 1- or 2-place figure, came fourth in the order of difficulty in three groups and fifth in one group.

If we divide the normal III² scores into general averages for all the examined pupils in Table XXIII, we obtain the following percentages:

Test	A	B	C	D	E	F	G	H	I	J	M
Per cent . . . . .	.49	.38	.39	.26	.39	.28	.22	.04	.11	.41	.88

No per cents can be computed for exercises K, L, N and O. The three best records of the subnormals are in addition tests, M, A, and J. The next best records are in the D multiplication and in the E addition exercises. The subnormals' poorest record is in fractions, H, followed by division, I.

It is evident from our results that subnormal and feeble-minded children when compared with normal children, acquire their greatest proficiency in addition and least proficiency in fractions, followed by division. This agrees with the conclusions generally reached respecting the mathematical ability of the feeble-minded, except that we find that they are weakest in fractions, instead of division, as has been stated by others.

In the following tabulation we give the indices of improvement in exercises A to F which the subnormal children made from grade I to grade II, from grade II to grade III, and from grade III to grade IV, based upon the figures in table XX; and the indices of improvement made by the normal children from grade III² to IV². The indices are secured by dividing the score made in a given exercise in a given grade into the scores made in the next higher grade in the same exercise.

INDICES OF IMPROVEMENT

Exercises	A	B	C	D	E	F	G
Subnormal Group:							
Grade II/I	2.45	2.39	3.65	5.23	2.85	5.61	6.46
Grade III/II	1.13	1.99	1.32	1.72	1.29	2.23	1.67
Grade IV/III	2.34	2.03	2.77	2.67	1.93	2.76	1.63
Normal Group:							
Grade IV ² /III ²	1.35	1.72	2.19	1.75	1.50	2.43	1.81

The significance of the indices for our subnormal group is, unfortunately, impaired by the absence of data for the first and second grades among the normal children. We can only make a comparison between the subnormals and normals in grades III and IV, but here the results for the subnormal group are not very significant because of the few pupils in grade IV. However, the amount of improvement from the third grade to the fourth grade is very markedly greater for the subnormal group in all the exercises except one. The difference ranges from 18% to 99% in the different exercises. The average chronological age is 1.46 years higher for the fourth grade pupils than for the third grade pupils (i. e., for those who had been examined), the B.-S. age is 1.46 years higher, while the fourth grade pupils averaged 1.4 years longer in school. The above factors, together with the fact that none of the fourth grade pupils were feeble-minded, will probably explain why the special pupils improved relatively more than the normal fourth grade pupils.

In the subnormal group the smallest gain was made from grade II to grade III, except in exercise G, multiplication of a 1-place figure by a 4-place figure. The small difference here may be due to the fact that the third grade pupils averaged only a

half year older, while they had not been any longer in school. They rated a year higher in intelligence. It is probably due to the higher intelligence rating that they did any better at all than the second grade pupils. The largest improvement in all the exercises was made from grade I to grade II. The large improvement between these grades is partly due to the fact that the second grade pupils averaged 1.2 years older chronologically and .99 year higher mentally (B.-S.) and had been 1.03 years longer in school. But since these differences are smaller than the corresponding differences between grade III and grade IV there must be some other factor or factors responsible for the large improvement. Possibly were the data available for the normal grades we should find the same phenomenon obtaining there. The first grade pupils are busy gaining control of the mere tools of computation. After they have gained this control they are ready for a big advance, or spurt, as it were, in the second grade. This is probably one factor. But we surmise that our first grade scores are abnormally low because some pupils were included who should have been classified as sub-first or kindergarten.

The greatest improvement in any exercise was in G, multiplication of a one-place figure by a 4-place figure, amounting to 546% between grades I and II, followed by 461% in F, subtraction of a 3-place figure from a 3- or 4-place figure.

GENERAL CONCLUSIONS

In connection with this summary we shall relate the conclusions derived from the arithmetic test with the conclusions previously drawn from the spelling and reading tests.

- 1 Subnormal children of the grade of imbeciles, or those grading IV- or V-years mentally or those classified as of kindergarten or first grade status are not able to function to any appreciable degree even in the simplest processes of arithmetic. The IV-year olds did not do a single example beyond E. One girl diagnosed as an imbecile failed on all exercises; an imbecile boy did two in A; a boy diagnosed as "deferred" did 6 in A and 1 in C, while a "deferred" girl did 12 in A, 8 in B, 3 in C and 2 in E. In the simple addition exercise (A) 11 of the 13 V-year olds scored, while 5 scored in B and E, 3 in C, and only one in D, and one in G and I. The pupil who scored one in I, scored 1 in E, 1 in B and 6 in A, and had been diagnosed as an imbecile. He was 11.3 years old at the time of the arithmetic test. The pupil who scored 1 in G, scored 3 in D, 1 in B and 6 in A, was 12.16 years old, and graded 5.2 by the 1911 and 5.6 by the 1908 at the age of 7.75, and was diagnosed as a potential moron. Of the V-year olds, 4 each had been diagnosed as imbeciles and potential morons, 1 as potential feeble-minded, 1 as backward and 2 as deferred. One of the two who made the best record in test A had been diagnosed as a potential moron and the other one as deferred. Ten of the 13 imbeciles scored in A, only two doing over 3 examples, while in exercises B, C, E and I the number who scored was only 3, 2, 2 and 1, respectively. Six failed in all except one, while only one scored in as many as 4 exercises, doing 6 in A, 1 in B, 1 in E and 1 in I. He was 11.3 years at the time of the arithmetic test. He graded 5.6 years by the 1911 scale and 6.4 by the 1908 at the age of 8.5. The average age of the imbecile group at the time of the spelling test was 11.8 and the average number of years in school 4. Moreover, except in exercises A, B, C, D, E and G less than half of the subnormals classified as of first grade were able to score. Of the 17 who did any examples in F, G, I, J and M, ten had been examined. Of these five had been diagnosed as potential feeble-minded. By the B.-S. they graded 7.8, 6.6, 6.3, 7.6 and 8.8. Two were borderline, grad-

ing 6.8 and 7.8 by the B.-S. One was a moron, grading VIII years mentally; one an imbecile, grading 5.6 mentally; and one an epileptic, grading normal in intelligence when examined.

It is evident that the arithmetic work proved to be too hard for the majority of the imbeciles, the V-year olds and the first grade pupils, and the conclusion suggested is that the teaching of arithmetic to imbeciles and mental defectives who have not reached a mentality of about six years does not result in the development of any useful form of skill. We reached the same conclusion regarding reading, and the same conclusion probably applies to spelling, but since greater choice was exercised in the selection of the pupils in spelling we did not analyze the data as minutely as we did in the case of reading and arithmetic.

Ideally the public schools should not be burdened with the instruction of low grade imbeciles of an intelligence level of three or four years or, in fact, any grade of imbeciles. But practically we are persuaded that at present imbeciles who have reached an intelligence level of four or five years should be admitted to the special classes in the public schools, not only because this is the age at which children may be admitted into the kindergarten in many states but, however meagre the results, something can be done for these children by prolonged and persistent training and unless the public schools assume this obligation the majority of these children will have to grow up without any school instruction, for many of the parents cannot afford to supply it privately, while the state schools cannot undertake the training of all of these children because of their overcrowded condition. Without training, these children will be far more of a burden and menace than with training. Moreover, it will be more economical for the public schools to undertake the training of these pupils, because the day schools will not have to bear the expense of clothing and feeding them. When the schools have finished their training they should be transferred to farm or industrial colonies when not properly cared for at home, for custodial care and such employment as they can render.

It goes without saying that the training given these low grade pupils in the public schools should be eminently practical. They should be trained in the proper care of their persons, in the control of their impulses, in self-help to others, and in the industrial pursuits in which they can be of service and helpfulness.

Any literary instruction offered them should be designed merely to develop elementary concepts incidentally through the manipulation of concrete objects, e. g., the matching and arrangement of objects, forms, colors, beads, the reproduction and construction of objects and shapes. In fact, many kindergarten and sensori-motor activities, plays and games will afford abundant opportunities for counting, adding to and taking away, noting magnitudes and observing the resemblances and differences incident to such operations. Similar types of activities with letter, word and number cards can be used for developing recognition of letter, number and word forms.

With respect to mental defectives above this grade, defectives commonly referred to as high grade imbeciles and morons (the latter of whom develop to about the nine-year level) we are convinced that the problem of instruction will have to be assumed by the public for many years to come, perhaps always. The public schools will have to train them for practical service at large in society, or in colonies when they cannot be given adequate supervision at home. While the chief emphasis in the training of these higher types should also be placed

on the development of useful forms of manual skill and proper habits of social response, we are justified in devoting a reasonable amount of time, say, one-third, to the elements of the literary branches. Certainly the majority of parents would vigorously object to the assignment of their pupils to special classes unless they were given some instruction in reading, spelling, writing and arithmetic, even if we considered all such instruction useless. Even the meagre results that can be secured in the literary work are in the long run, we believe, worth while. They are an element in rendering the mental defective slightly more efficient, human and happy. Most of the children we have tested had given from one-third to over one-half of their time to the study of reading, spelling and arithmetic. The limited potentialities of mental defects in reading, spelling and arithmetic have been shown in the preceding pages and will be referred to again in section 5 below.

- 2 If we disregard the exercises which are too difficult, there is a patent improvement in arithmetic ability from grade to grade, from intelligence category to intelligence category, when the comparison is confined to the major categories (the backward excepted), and from intelligence age to intelligence age (B.-S.). We found the same result in the oral reading test and Starch spelling lists. In the Ayres spelling lists there were numerous exceptions, due, undoubtedly, to the way in which the teachers selected the pupils for the different columns. While there are exceptions, we have found that the chronological and B.-S. ages and the amount of time spent in school increase as we ascend in all the classifications in all of these tests, i. e., the spelling, reading and arithmetic tests. Undoubtedly this accounts for the improvements found in the tests, just as the losses or lack of gains which have been noted are accounted for, at least in part, by the exceptions found to these general tendencies. The reason that the backward did poorer than the borderline in all of the different tests is that they were younger and had not attended school as long as the borderline.

The largest gains were made in grade II compared with grade I, and by the morons compared with the imbeciles, in all three types of tests while the B.-S. age in which the largest gain was made is not the same in the spelling, reading and arithmetic tests. The great improvement made by the second grade pupils is probably due to the fact that the first grade pupils (at least among normals) are engaged in gaining control of the mere mechanics or tools of spelling, reading and number. It is also probable that pupils were classified in the first grade who were of kindergarten or sub-first status. The great improvement among the morons is due to the inclusion of large numbers of imbeciles who could not function at all in the tests. In fact, from the pedagogical point of view the upper limit of imbecility may perhaps most properly be drawn, and often actually is drawn, at the intelligence level where only the merest rudiments of spelling, reading and arithmetic can be acquired, and then only after protracted drill. The imbecile is located at the very bottom of the capacity curves for reading, spelling and arithmetic, while the highest grade idiot does not even approach the zero point of the curves. He is entirely extra-human with respect to the ability to acquire reading, spelling or arithmetic. The young infant suffers from a similar temporary inability. With the idiot the inability amounts to a permanent disability.

- 3 The lack of norms for the first two grades greatly limits the value of the spiral arithmetic exercises for determining both the relative improvement and

the relative status of subnormal children. We have emphasized the same limitations in the Ayres spelling lists. Steps should be taken to supply norms for the missing grades.

- 4 The relative improvement in the subnormal group is much greater than in the normal group in grade four compared with grade three, and possibly in the lower grades also. In the reading test the subnormals clearly improved more with ascending grade than the normals, while in the spelling tests, possibly due to the fact that the children were partly selected, as we explained before, the results are discrepant. It should not be forgotten that the subnormals usually made lower scores than the normals classified in the same grade, and that they were considerably older. In experiments with the Seguin form board we found that the subnormals improved more than the normal pupils, but the relatively greater gain was in the younger ages.* It is probable that the subnormals would not continue to gain more than the normals as we ascend higher and higher in the grades. The subnormals would reach their limit of development sooner than the normals. Probably the chief reason that subnormals often improve more than normals is that they make lower initial scores.
- 5 While the exact efficiency status of the different grades of our subnormals cannot be exactly determined because of the inadequacy of the norms, we may point out that only in two arithmetic exercises were the averages, based on all of the subnormals who had been examined, equal to 50% of the normal III² scores. In the large majority of the exercises our third grade subnormals did less than 70% as well as the III² normals, our fourth grade subnormals surpassed the IV² normals in ten tests, while our IX-year subnormals were equal to or surpassed the normal III⁴ pupils in about half of the exercises. Only the minority of the special school pupils included in these groupings had been classified as feeble-minded. The pupils classified as backward did from 63% to 86% as well as the normal III² pupils in six tests.

In discussing the achievements of the highest grade of feeble-minded pupils (frequently referred to as morons), let us specially emphasize that we use the term "feeble-minded" in its fundamental social connotation, which alone can serve as the basis for a legal definition. Moreover, we use the word in conformity with recent British and American statutory definitions.†

According to the English Mental Deficiency Act of 1913, the feeble-minded are defined as "Persons in whose case there exists from birth or from an early age mental defectiveness not amounting to imbecility, yet so pronounced that they require care, supervision, and control for their own protection or for the protection of others." If the social and industrial dependency or incompetency cannot be ascribed to mental deficiency, the condition, clearly, is not one of feeble-mindedness.

The definition of a feeble-minded person in Missouri is contained in a bill which we introduced in the legislature through the Children's Code Commission governing the commitment of feeble-minded persons to state colonies, and which was enacted into law in May, 1919. (But vetoed by the

*Psycho-motor Norms for Practical Diagnosis, 1916, p. 28.

†In one of our western states, however, the feeble-minded person has been defined as one who does not develop beyond a XII-year level of intelligence. The weakness of this academic definition of feeble-mindedness will be stressed on a later page.

governor for reasons which had nothing to do with the merits of the bill.) Under the provisions of this act, the legal definition of a feeble-minded person reads as follows:

"The words 'feeble-minded person' shall be construed to mean any person afflicted with mental defectiveness from birth or from an early age, so pronounced that he is incapable of managing himself and his affairs and of subsisting by his own efforts, or of being taught to do so, and who requires supervision, control and care for his own welfare, or for the welfare of others, or for the welfare of the community, and who cannot be classified as an insane person." The legal definition in Illinois, adopted in 1915, is practically the same.

In view of everything that has been written on the subject during the last few years it is surprising to find that some psychological, social and medical writers are still insisting on the obsolete definition of the English Royal Commission, which from the standpoint of logical requirement is defective both in connotation and denotation and which from the standpoint of practical workability is quite impossible. It is evidently because of these facts that the definition was abandoned by England herself in 1913. It cannot be too strongly insisted that the word "feeble-minded" should never be used except in its social and legal implications. To be sure, feeble-mindedness can be located at any point in an I. Q. scale— at 60, 70, 80 or 90, to suit anyone's whim—or anywhere in an intelligence age scale, but the significance of such a definition is academic and theoretical, and it can not be converted into a formula for pronouncing a person "incapable of managing himself and his affairs and of subsisting by his own efforts" because of innate or early acquired mental deficiency, unless the degree of mental deficiency is so serious that there can be no doubt of the individual's social dependency. Examiners who are not specialists on feeble-mindedness in all its fundamental aspects should not employ the term at all. They should be satisfied to classify the individual as "mentally inferior," or "subnormal" or employ some analogous term. To employ the term feeble-mindedness in the loose way in which it has been used in the United States during the last decade, and to publish exaggerated statistics of feeble-mindedness, is to do science a disservice, however lofty the intentions may be.

What do we find, then, with respect to the morons? In only one exercise did the morons exceed 36% of normal III² efficiency. Only a few individuals did better than third grade in any of these exercises, and it is questionable whether some of these could properly be adjudged feeble-minded on the basis of the social criterion. Had the norms been available it is probable that the average efficiency of the highest grade of feeble-minded children would have been found to be somewhere in the second grade. This conclusion is in harmony with the results of our earlier study. 88% of the pupils then graded by the teachers did from sub-kindergarten to second grade work, 11% did third grade work and only one was graded higher than third grade. Some of those doing third grade work were not feeble-minded.* In the spelling tests we found that the morons on the average did not do better than second grade work in the Ayres lists and less than second grade in Starch's lists, while in the Gray oral reading test we found that they reached the third quarter of the second grade. In other words, the morons, after having reached 13 years of age and after having spent almost six years in school, did not do better than

*The Pedagogical Status of the Feeble-Minded School Children, *The Elementary School Journal*, 1918, p. 594.

normal children of eight or nine. As we have already pointed out, there are exceptional individuals, of course, who may do better.

It is evident that this conclusion does not support the claim that the majority of "morons" are found in the fourth, fifth and sixth grades, while it also calls into question the wide-spread custom of assigning pupils to special day classes for the feeble-minded and of committing children as feeble-minded to custodial institutions who do work in the fourth, fifth and sixth grades.* Such pupils should be sent to ungraded classes instead of special schools for mental defectives, and if they are committed to custodial institutions as incompetents the incompetency must be justified on other grounds than mental deficiency, or inability to do successful work in or beyond the third grade.

Until within recent times no attempt was ever made rigidly to determine the upper limit of feeble-mindedness either in terms of intelligence capacity or scholastic capacity. That under these conditions children were mistakenly assigned to special classes or committed to institutions as mental defectives should occasion no surprise. Manifestly it could frequently not be predicted whether a young retardate would or would not be socially incompetent as an adult. No facts have been produced during the last decade, in spite of the progress made, which have demonstrated scientifically and unequivocally, that all pupils must be classified as feeble-minded who merely have the capacity to do third grade work, and certainly not if they can do work beyond the third grade. On the other hand, the conclusion which we have reached regarding the possible pedagogical attainments of children whom we have felt justified in classing as feeble-minded on the basis of a careful examination and years of reports and observations of the work of many of them, is in complete harmony with the deductions of British, French and American writers who have had extensive experience with the feeble-minded.

Mrs. Hume Pinsent, the founder of the Birmingham After-Care Committee, found that in the special schools for mental defectives in Birmingham the best of the pupils at the age of 16 were "able to read and calculate to about the same extent as a normal child of eight or nine." These pupils averaged about three years older than our highest grade of mental defectives. With three additional years of instruction our pupils would undoubtedly grade somewhat higher in the tests we gave. Tredgold likewise, in commenting on the most intelligent of a class of pupils of the average age of 12 in a typical public day school in London, remarks: "excluding a few children—who in my opinion, are not really defective—it may be said that the scholastic acquirements of none of these children come up to normal standard II." Burt, of the London public schools, writes: "In a survey of 600 special school children I found only 7 per cent up to and none above, the level of Standard II. This is equivalent to a scholastic age of eight. Evidently those who control the retransferences to the ordinary school have decided that a child, on reaching the scholastic age of about nine, shall be deemed no longer fit for retention in a special school for the mentally deficient." Binet, speaking of French mental defectives, states that "the best endowed did not surpass the normal level of 9 or 10," while his co-worker, Simon, provisionally fixed at "9 years the upper level of mental debility (feeble-mindedness).... A development equivalent to the normal average at 9 years of age is the minimum below which the individual

*We have referred to this practice in *Problems of Subnormality*, 1917, Chapter I.

is incapable of getting along without tutelage in the conditions of modern life." Cornell, after experience in examining mental defectives in the Philadelphia schools, concluded that "the high grade feeble-minded as a rule stick fast" in "the third school grade." "The third grade very largely corresponds as a test to the ninth-year Binet test, and the great majority of high-grade feeble-minded children, eleven or more years of age, with exceptions either way, test nine years plus by the Binet and coincidentally with third grade in school work.*

If these conclusions are correct, what shall be said of the diagnosis of feeble-mindedness which has been made of children promoted to the high school, and of a large number of delinquents and criminals who had been advanced into the middle and upper grades in the elementary schools? It may be said that the only evidence frequently presented that the subjects in question were feeble-minded has been the fact that they were retarded over three or four years in intelligence by the B.-S. scale, or had an I. Q. of less than 70 or 75, or were unable to go beyond the XII-year level in the B.-S. scale. There are two fundamental weaknesses with this type of proof of feeble-mindedness. First, the standards were laid down prematurely, i.e., before evidence had been gathered to show that they were valid. At best these standards were only assumptions, and should only have been used tentatively as working hypotheses. Second, evidence is in hand to show that the standards are too high. For example, four out of six students, one in the high school and five in a teachers' college, whom we examined by the 1911 scale would be feeble-minded according to the XII-year standard. All of these students have graduated since they were examined. We have no data on the after career of the high school boy, but every one of the teachers has amply demonstrated her capacity since she entered the teaching profession. Many delinquents and prostitutes have been diagnosed as "high grade morons" who scored just as high in the B.-S. scale as four of our students who have been quite successful as teachers. Other writers have presented similar facts. Thus Helen Thompson Woolley has pointed out that the XII-year standard would throw into the feeble-minded class 40% of adults studied by her who had limited experience and who were engaged in unskilled labor.

The evidence has been greatly extended by the recent psychological examination of a million and three quarter men in the United States army. The complete account of this work has not yet appeared in print.† The general tabulation, however, shows that the average intelligence level of the white United States soldier is 13.1 years. Some writers believe that this finding represents the average intelligence status of the American white adult. This conclusion has a profound and decisive bearing on the question of the location of the upper limen of feeble-mindedness, which has been a matter of constant and pointed controversy during the last decade. We now discover that the intelligence standard on the basis of which dependent or delinquent persons have been diagnosed as "indubitably" or "definitely" feeble-minded (under the specific designation of "high grade morons"), falls only a small fraction of a year below the average intelligence level of the white American soldier

*The references to the above citations may be found in our *Problems of Subnormality*, 1917, pp. 37 and 220, and in Burt's review of this book in *The Eugenics Review*, 1919, pp. 224-231.

†Yerkes, Robert M. (Editor), *Psychological Examining in the United States Army*, *Memoirs of the National Academy of Sciences*, 1921, pp. 890.

of the selective draft and assumedly of the average white American citizen. Some years ago we ventured the prediction that "many millions of our citizens" would be found feeble-minded by the XII-year standard. We felt at the time that we were conservative in our judgment. Now on the basis of the same standard, which is still defended and actually followed in practice by a few examiners in spite of the irrefutable objections which many for years have urged against it, we find that we would have to classify almost half of the American white adult population as no higher in intelligence than feeble-minded persons, and presumptively subject to custodial care, for those who have been most vigorous in promulgating and defending the XII-year standard have said that morons are persons whom "we cannot prepare for a life of independent action. They cannot provide for themselves, much less contribute anything to the general welfare." In California the legislature has decreed that a feeble-minded person "will not develop beyond the level of the average child of twelve years." If the army results apply to the general population, as affirmed, we are forced to the conclusion that the intelligence level of almost half of the white citizens of that commonwealth is barely above the status of the high grade feeble-minded child.

A prominent chief of a government scientific division recently related to the writer that a psychological investigator, enamored of the Mendelian theory, threw away all the data gathered in a survey because they disagreed with the Mendelian hypothesis. Such a spectacle is akin to the insistence that dependents and criminals are feeble-minded although they may have almost average and sometimes fully average intelligence. Some one has said that half of what is taught in our books and schools is not true. In one medical investigation the results supported this seemingly preposterous statement. The post mortem examinations in a London hospital showed that about half of the ante mortem diagnoses were incorrect. This may be an indictment of our low level of intelligence our—"moron" status—but we prefer to regard the fact merely as an indication of the enormous difficulty of the problem of physical diagnosis. Certainly accurate mental diagnosis is no easier.

Fortunately for the science of clinical psychology, however, most of the trained psychological examiners are cautious and conservative, and free from hampering prepossessions as to feeble-mindedness. The directors of the army psychological work came to the conclusion that it was not necessary to examine anyone as a feeble-minded suspect unless he graded less than X-years in the group psychological tests (i. e., less than 15 points in the so-called Alpha test). No one was recommended for discharge as feeble-minded unless he graded less than 7.8 years mentally (Stanford scale), those who graded from 7.8 to 10.2 were recommended for assignment to service organizations or development battalions, while those who graded 10.3 or higher were recommended for the regular military training. The individual records showed that any number of men of X- and XI-year mentalities comported themselves properly in society and had been able to earn their living. In fact, instances have been cited of men of still lower intelligence levels who were earning good wages and getting along satisfactorily at large. Coal miners from West Virginia earning \$7 a day could not pass the seven-year level. An old cavalry officer

in a southern camp "cussed out" the neurologist who recommended the discharge of a soldier who had a seven year mentality. The officer said that this man was the best stable boy in the troop.*

Certainly if the mental age of the average American citizen is 13.1, the mental age of the highest grade of feeble-minded person must be at least several years lower. If we follow the standards of feeble-minded which were proposed a few years ago and which are being widely followed, namely, an I. Q. of 70 or less or a retardation of four years or more, then the highest grade of mental defective (the high grade moron, so-called) would not exceed an intelligence level of 9. years.† This apparently corresponds to the standard which we have followed during the last nine or ten years, for when we placed the upper threshold of feeble-mindedness near the Xth-year, we were using the 1908 scale which grades considerably higher than the Stanford scale, except possibly in the higher years of the scale, which we have not had occasion to use with the type of cases we examine. This standard, moreover, corresponds to the standard of such cautious experts on the feeble-minded as Binet-Simon, Woolley, Cornell, and Tredgold.

The practical importance of adopting a reasonable standard of feeble-mindedness should be obvious. In the first place, people have been committed to institutions for the feeble-minded on the X- and XI- and XII-year standards who have higher degrees of intelligence than many persons who are successful at large in society. Thus many of the children who have left the special schools in St. Louis and who are now making their living, some having a fair income, actually grade lower intellectually than children who have been committed to custodial institutions as feeble-minded. Likewise many of the army recruits who have been economically successful in society had considerably less intelligence than high grade inmates in institutions for the feeble-minded.

Is it too much to plead that no child should be committed to an institution for the feeble-minded until he has been carefully examined by experienced examiners who have specialized on the problems of mental deficiency and backwardness? Taking the nation as a whole it may be true, as alleged, that the majority of children are still certified as proper candidates for institutions for the feeble-minded by examiners who have never taken a single course in

*We have just received an interesting and valuable study of the intelligence of delinquent boys 30% of whom are classified as feeble-minded. If we deduct the boys who had XI-year mentalities the percentage is reduced to 23.8, and if we also deduct the X-year mentalities (most of whom grade near the XI-year border), to 13.2. Of the 141 classified as feeble-minded all except ten, having intelligence levels from X-XII, would have been recommended by the army psychologists for regular military service. By feeble-minded persons the writer states that he means those "who need constant supervision in even routine work, and who are unable to plan for themselves and they are therefore said to be incapable of managing themselves and their own affairs independently." We have been forced to the conclusion that the large majority of subnormal delinquents are of borderline and backward degrees of intelligence instead of being feeble-minded: *Problems of Subnormality*, 1917, 239-250, 181f; *Feeble-mindedness and Delinquency*, *Mental Hygiene*, 1917, 585f; *Criminal Irresponsibility*, *Journal of Delinquency*, 1916, 250f. The high percentage of feeble-mindedness reported among our delinquents is due to the fact that they have been a highly selected group. Most of them were referred for examination because they were thought to be mentally defective.

†Terman has affirmed that an I. Q. below 70 indicates "definite feeble-mindedness," that many with a still higher I. Q. are also feeble-minded, that age sixteen which represents adult intelligence is the highest age that can be used to determine the I. Q. of an adult. On the basis of this standard an adult, or an adolescent of 16 or over, would be feeble-minded when retarded only two years in intelligence according to the army average of adult intelligence. Aside from the inherent improbability of such a standard, let us not forget that the age norms in the Stanford scale are based on so few cases, especially in some ages, that we are not justified in assuming that they are satisfactorily accurate and can be applied without modification to the intelligence rating of any person anywhere. The army average varies surprisingly from the Stanford adult average.

mental deficiency, who have very hazy ideas as to what constitutes feeble-mindedness, and whose diagnosis is based either on common sense considerations rather than expert knowledge, or on arbitrary standards of intelligence deficiency as determined by some measuring scale of intelligence.

In the second place, thousands of children throughout the country have been assigned as feeble-minded on the basis of the above and allied standards to classes for mental defectives in the public schools who have not been feeble-minded. This may not seem to be a matter of any consequence, but we personally know of many instances where such assignment proved to be a detriment to the pupils, who were actually held back by the slow pace of the feeble-minded children and by the inexperience of the teachers with the work in the higher grades. We have removed from special classes for the feeble-minded children who are now doing "good" and "excellent" work in the upper elementary grades and in high school. Their cases are little less than tragic. Had they been retained in the special schools for mental defectives they would not have gone beyond the fourth or fifth grades before leaving school. Assignments to special classes must be made with far greater care in the future than has been the case in the past. This cannot be done unless the schools secure the services of experienced and trained experts on mentally handicapped children.

Pupils who have the capacity to do good all-round third grade work should not be assigned to special classes for the feeble-minded save under exceptional conditions. They should be assigned to ungraded classes designed for children of higher degrees of intelligence. The minimum requirement for handling subnormal children when there is a sufficient number of different grades of subnormals in the school system, calls for the organization of special schools for the mentally defective (feeble-minded), and ungraded classes for the backward and restoration types. The majority of the borderline should be assigned to the ungraded classes. When feasible only the borderline who will eventually probably prove to be feeble-minded should be assigned to the special schools. Our insistence that backward children should not be assigned to the special schools for the feeble-minded except under very special circumstances is in complete harmony with Binet's views. Obviously where only one class is available it must serve as a clearing house for various grades of mental deficient. But the backward child should be returned from such a class to the grades as soon as the instruction in the grades meets his needs better than the instruction in the special class. We have discussed the organization of different types of special classes in some detail in *Problems of Subnormality*, 1921, Chapter III.

6. Relatively to the normal pupils, the feeble-minded and subnormal pupils do worst in fractions and division, and best in addition.
7. The boys tend to surpass the girls in arithmetical work, especially in division and subtraction. On the other hand, the girls excelled in the reading test, and possibly in the spelling tests, although the results are somewhat equivocal in spelling. We do not yet know the significance or implications of these sex differences in the literary subject matter either among normals or subnormals: whether the differences can be leveled by added drills, whether it is desirable to level them or to increase them, and whether the literary course of study should differ for boys and girls because of these differences. The opinion has been frequently expressed that the reason there are more

pedagogical retardates among boys than among girls in the elementary schools is the fact that the dominantly literary character of our elementary curriculum appeals more to the interests of girls than boys. In response to this conviction many forms of manumetal work for boys have been introduced into the elementary course. At the present time, however, the tendency is perhaps equally strong to introduce various forms of manual work especially suited to girls. This question is in need of intensive investigation.

8. The variability in the arithmetic exercises is very great, the quartile deviation ranging from 36% to 86% of the average scores in the different grades. How much larger the variability is for subnormal than normal pupils cannot at present be determined. There were some pupils who failed completely in every grade except in two exercises in grade III, and seven exercises in grade IV. The number of pupils who were conspicuously weak in number work is very considerable. It has usually been stated, and we believe it is true, that mental defectives have less ability in arithmetic than in any other literary branch. This is no doubt due to the highly abstract nature of number and numerical operations. At the same time, the mathematical incapacity of some of these children is probably due to a specific weakness in number imagery or number concepts, a condition comparable to visual aphasia in the realm of reading. There are also subnormal children who have special ability in number work although we did not find any one with very conspicuous ability. The literature occasionally refers to "mathematical prodigies" who are imbeciles. But these defectives are probably morons or unstabiles rather than imbeciles.

We found similar conditions with respect to variability to obtain in spelling and reading.

It is evident that, hard as it is to teach the literary subjects to mental defectives, the problem is far more difficult when the mentally defective child is also specifically handicapped. When there is a specific defect in his visual word, letter and number imagery the problem is practically insoluble. In the case of children of higher degrees of intelligence suffering from this condition, favorable results are frequently obtained after protracted drill, especially when efficient methods are employed. We believe that there are more children of fair or normal intelligence who suffer from defect in visual word, letter and number imagery than has been supposed, and that the time is ripe for the organization of experimental classes for these types. This will lead to the intensive study of the pedagogy or word blindness in all its forms.

9. Although, as we have seen, the proficiency in arithmetic, as well as in spelling and reading, tends to increase with increasing intelligence age, the variability is so great that it would not be possible to classify pupils in any of these subjects purely on the basis of the intelligence age. The intelligence age, or general supernormality or subnormality, is only one factor to be considered in the pedagogical classification of pupils. Among other important factors which must be taken into account, are specific mental and pedagogical defects and talents and the pupil's stage of instruction. The proper classification of a child for purposes of instruction must have regard for all these factors, while with certain types the physical and nervous condition must also be considered.

Let us emphasize, in conclusion, a point of great practical importance which we have already stressed and which has been implicit in many of the statements which we have already made: the problem of psychological and

educational diagnosis is not simple, but exceedingly complex. There are many conditions which superficially appear to be similar, but which are quite dissimilar. This is not surprising when we consider that there are all grades of mental subnormality imperceptibly shading into each other and often inextricably intertwined with co-existent specific mental and physical defects. But the direction of progress in education and social service (as in medicine) is in differentiating more and more sharply the various degrees of quantitative deviation in intelligence and to identify more and more accurately specific abnormalities which we find in the mentally handicapped. Only thus shall we be able adequately to differentiate our courses of study to meet individual needs. There is no justification for differentiating pupils at all for instruction unless by so doing we can more effectively minister to the child's particular needs. If this is true, then we must continue to differentiate pupils into more and more groups just so long as the finer groupings will make possible a more effective adaptation of our educative processes. It is particularly important to differentiate feeble-mindedness from other degrees of intelligence deficiency and from various other handicaps and specific defects which may border on, resemble or simulate it, such as motor, visual and auditory aphasia, speech defects, sensory defects, psychopathic, psychotic or neurotic disorders, social and educational neglect, etc. In order that educationally abnormal children may be carefully differentiated the schools should have the services of examiners who are not only versed in clinical psychology and mental tests, and elementary and corrective pedagogy, but who have expert knowledge of various types of abnormal school children.

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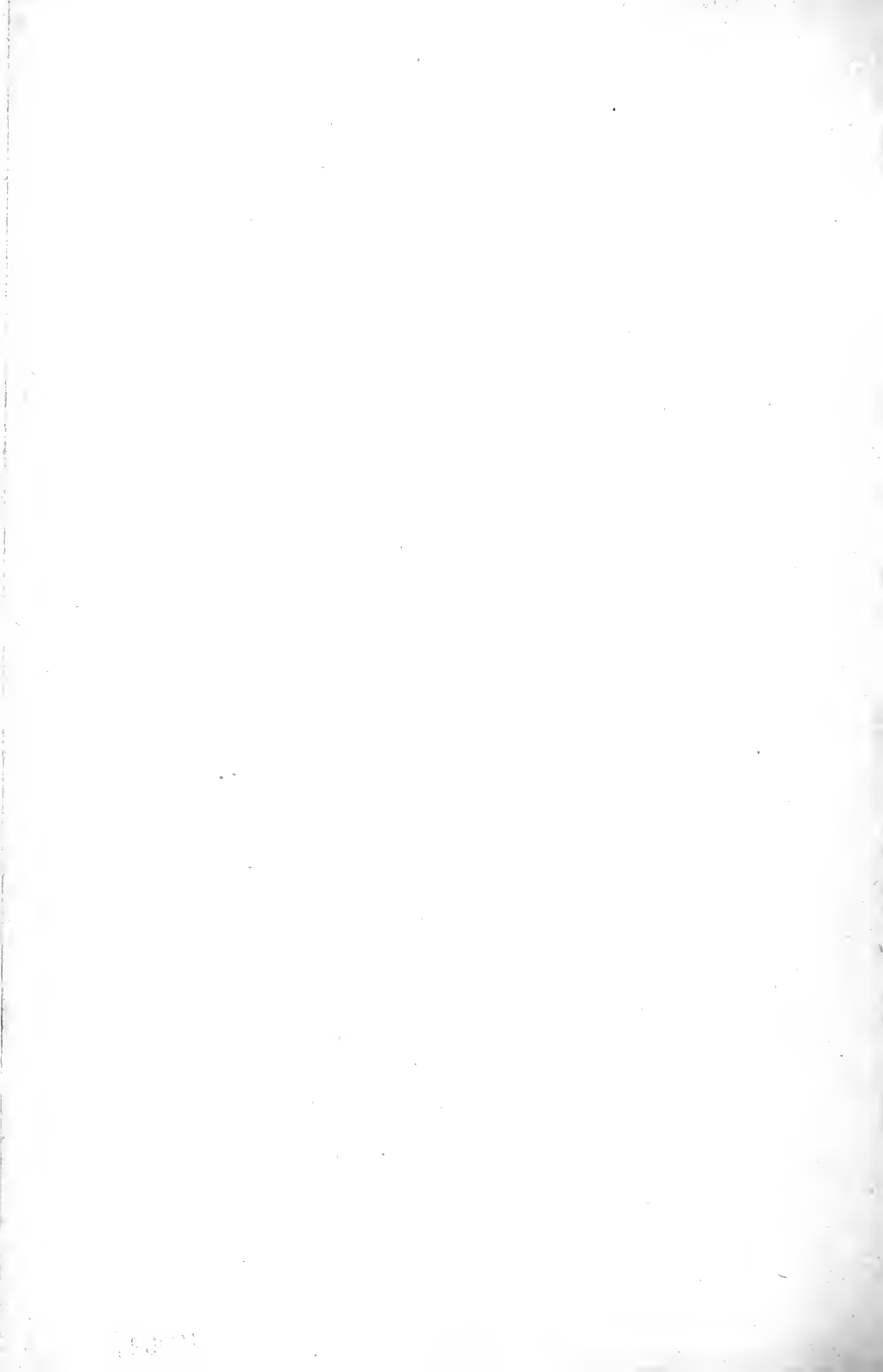
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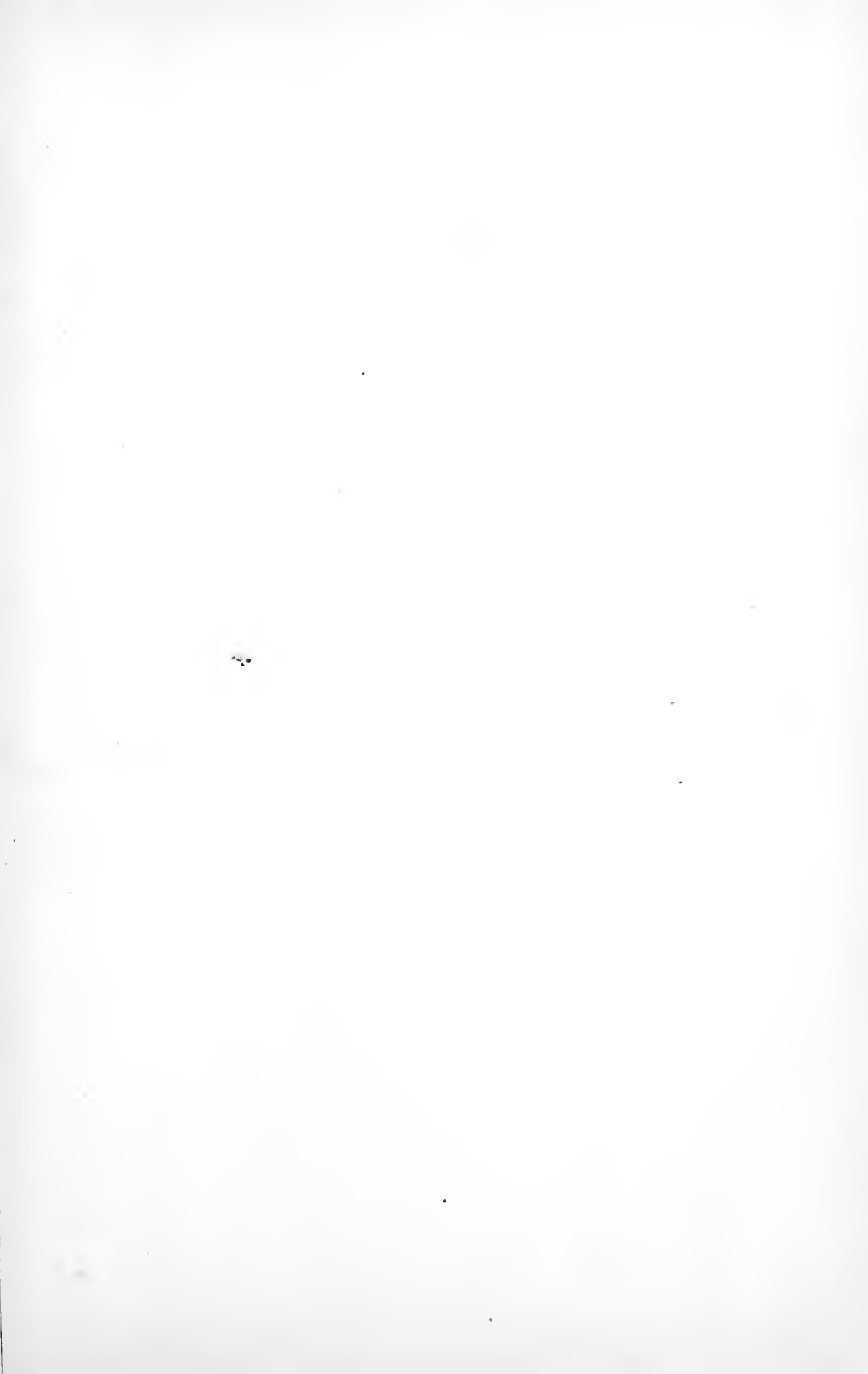
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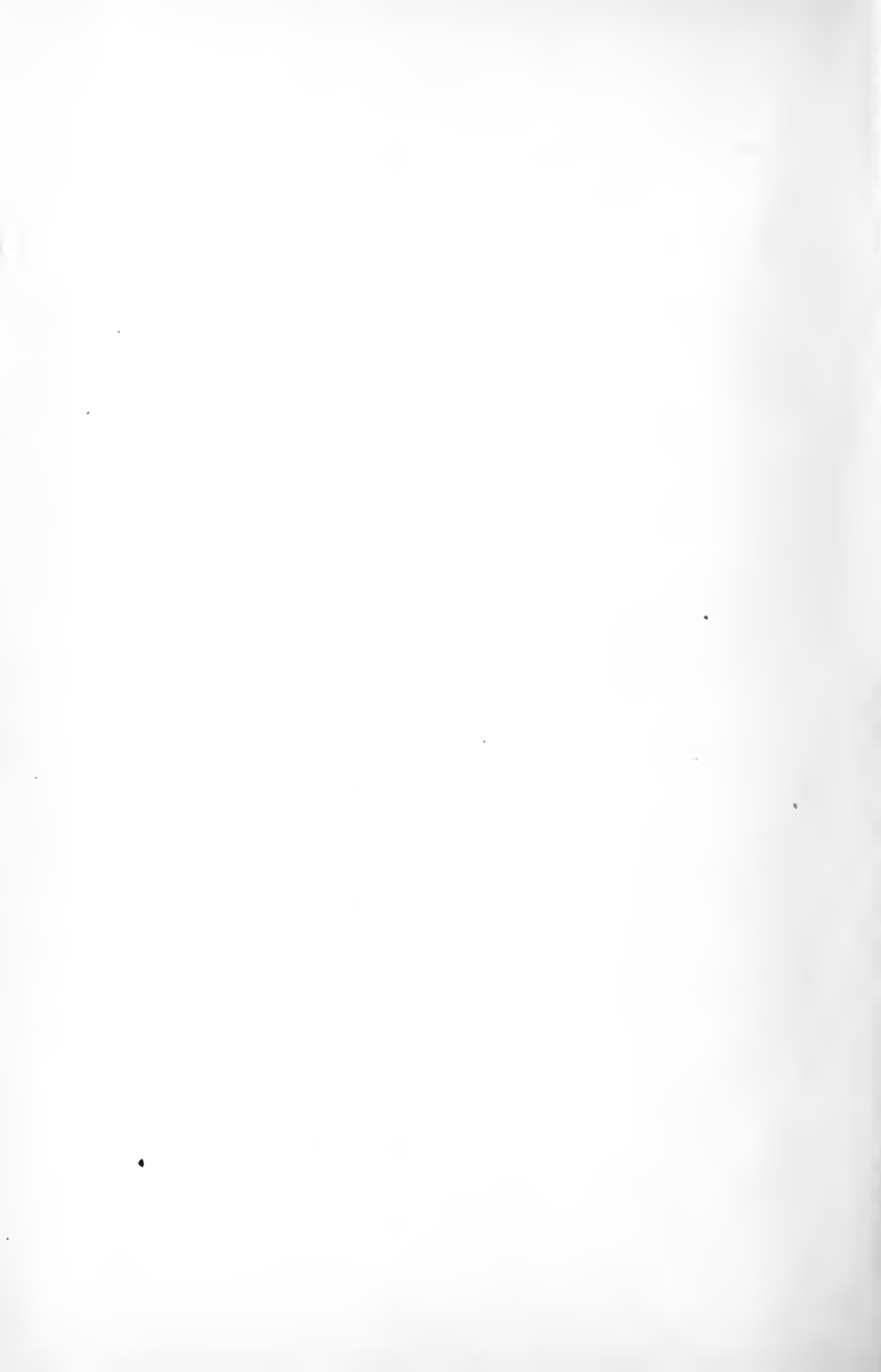
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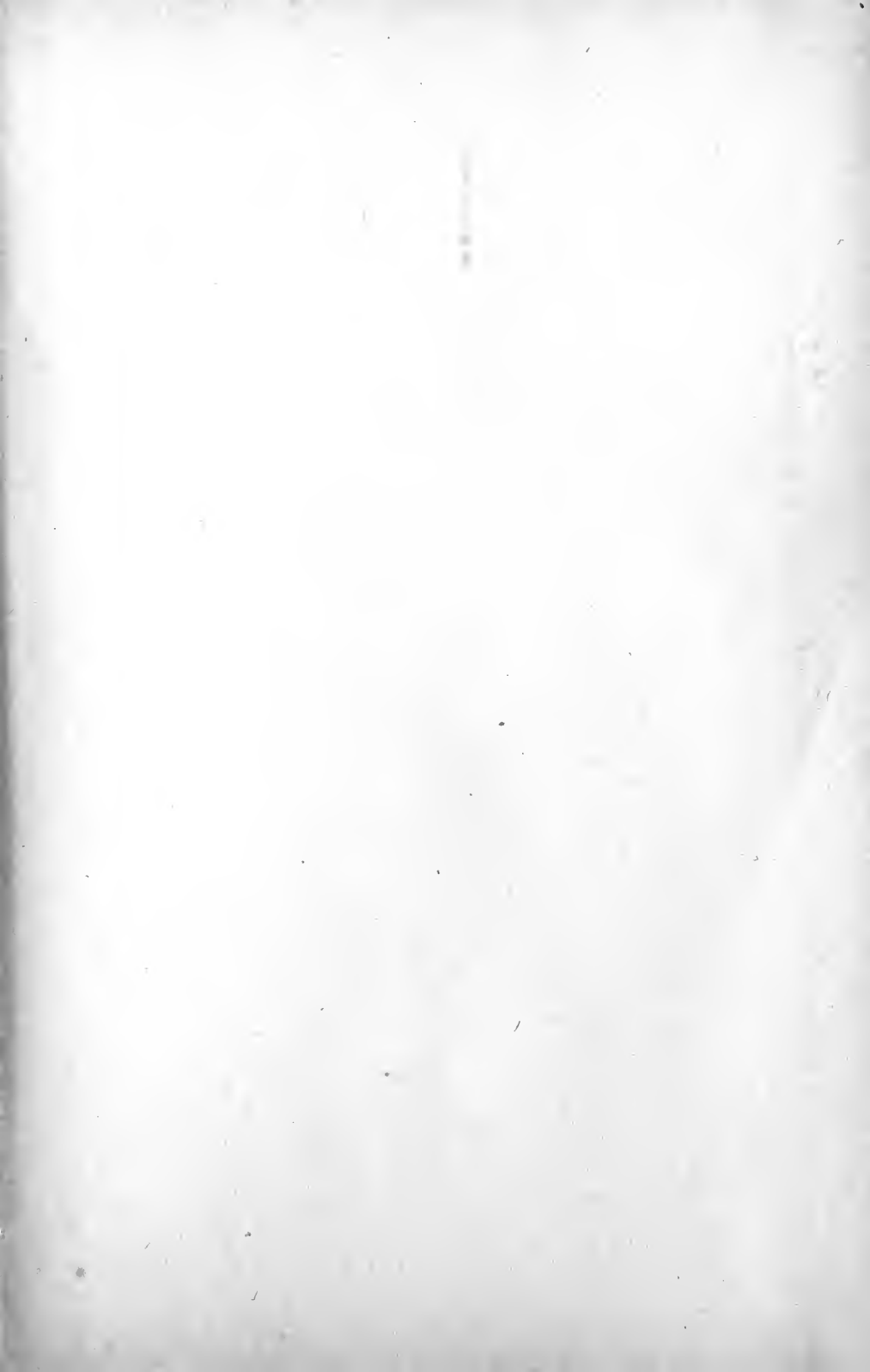
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